CELEBRATING THE 2025 INTERNATIONAL YEAR OF GLACIERS' PRESERVATION

YOUNG SCIENTISTS' MEETING

27-29 August 2025, 14:30 to 17:30 Hrs. IST

United Nations
Educational, Scientific and
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THE WORLD ACADEMY OF SCIENCES
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TWAS CASAREP

JNCASR



Young Scientists' Meeting
on
Earth's Changing Contours
The Interplay of Forces & Time

REPORT

Organized by
TWAS Central & South Asia Regional Partner
(TWAS-CASAREP)
Jawaharlal Nehru Centre For Advanced Scientific Research, Bengaluru, India

United Nations
Educational, Scientific and
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Program Details

27 August 2025 (Wednesday)
Introductory Session

2:30 - 2:35 pm (5 min)	Welcome and Opening Remarks: Prof. G.U. Kulkarni Former President & Coordinator of TWAS CASAREP, JNCASR, Bangalore, India
2:35 - 2:40 pm (5 min)	Remarks: Prof. Umesh Waghmare President, JNCASR (host institute of TWAS CASAREP), Bangalore, India

Scientific Session 1
Invited Lectures

2:40 - 2:45 pm (5 min)	Meeting Highlights: Dr. Jaishri Sanwal Bhatt Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India
2:50 - 3:30 pm (40 min) Online	Speaker: Prof. B.N. Upreti, Nepal Academy of Science & Technology, Kathmandu, Nepal Title: Seismotectonics of the Himalaya and the current understanding on the possible earthquake hazards in the region
3:30 - 4:30 pm (60 min) Online	Speaker: Prof. Mona Lisa, Department of Erath Sciences, Quaid-i-Azam University, Islamabad, Pakistan Title: Seismicity, Seismotectonics, and Seismic Hazard Assessment of the Himalaya and Makran Subduction Zone, Pakistan

Break: 4:50 - 5:00 pm (10 min)

5:10 - 5:20 pm (10 min) In Person	Speaker: Dr. Menuka Maharjan, School of Forestry and Natural Resource Management, Institute of Forestry, Tribhuvan University Title: Farmer's Flood Adaption Strategies in the face of climate change in the Chure- Terai Region of Nepal
5:20 - 6:00 pm (50 min) Online	Speaker: Prof. Mary S. Hubbard, Professor Emerita, Montana State University Bozeman, Montana, United States Title: Himalayan contours: interplay of tectonics and climate

28 August 2025 (Thursday)
Session 1 - Invited Lectures

2:30 - 3:25 pm (55 min) In Person	Speaker: Prof. Ramachandran Shankar, Institute of Mathematical Sciences, Chennai, India Title: The Changing Cryosphere
3:25 – 4:25pm (60 min) Online	Speaker: Prof. Ayşegül Askan, Earthquake engineering - Engineering seismology, Middle East Technical University Ankara / Türkiye. Title: A Review on the Recent Large Earthquakes, Numerical Simulations and Urban Seismic Resilience in Türkiye
4:25 - 5:15 pm (50 min) In Person	Speaker: Prof. Binod Sreenivasan, Centre for Earth Sciences, Indian Institute of Science, Bangalore. Title: Earth's dynamic magnetic field and its origin

Break: 5:15 – 5:30 pm (15 min)

5:30 - 6:10 pm (50 min) In Person	Speaker: Prof. Michał Krobicki, Faculty of Geology, Geophysics and Environmental Protection, AGH University of Krakow, Poland Title: The Early Permian breakup of Pangea (Himalayan belt) and Early Jurassic(?) drift of the Lhasa Block from the Peri-Godwanan margin – palaeogeographical reconstructions from SE Asia perspective.

29 August 2025 (Friday)
Session 1 - Invited Lectures

2:30 - 3:10 pm (40 min) In Person	Speaker: Prof. Thamban Meloth, National Centre for Polar and Ocean Research (NCPOR), Goa Title: Exploring Poles in a Changing World – New Frontiers and Indian Endeavors

Break: 3:10 – 3:20 pm (10 min)
Session 2 – Presentations by Young Scientists

3:20 - 3:30 pm (10 min) In Person	Speaker: Dr. Yegizbayeva Asset, National Center of Space Research and technology, Kazakhstan Title: Geospatial Technologies for River Flow Modeling and Water Resource Management under Climate Change: A Case Study of the Lake Balkhash Basin
3:30 - 3:40 pm (10 min) In Person	Speaker: Dr. Manasi Debnath, School of Sciences, Nagaland University, India Title: Assessment of Glacial Lake Dynamics and Outburst Flood Risk in Lachung Basin, Sikkim Himalaya Using Multi-Criteria Decision Analysis and Analytic Hierarchy Process"
3:40 - 3:50 pm (10 min) In Person	Speaker: Mr. Ramesh Kathariya, International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal Title: The Fate of Biodiversity in a Changing Climate
3:50 - 4:00 PM (10 min) In Person	Speaker: Ms. Rina Rani Palei, Indian Institute of Technology Kharagpur, India Title: Linking Indonesian Gateway Restriction to Surface Hydrographic Changes in the Southeastern Indian Ocean Since the Latest Miocene.
4:00 - 4:10 PM (10 min) Online	Speaker: Dr. Som Dutt, Wadia Institute of Himalayan Geology, India Title: Unsteady Indian Monsoon and Evolving Climate Forcings during the Late Quaternary
4:00 - 4:10 PM (10 min) Online	Speaker: Dr. Remya S. N., Azim Premji University, India Title: Investigating the 2023 South Lhonak Lake Outburst in Sikkim: Dynamics, Triggers, and Impacts of a Himalayan GLOF Event.

Concluding Session

Meeting Report

Executive Summary

The three-day hybrid meeting, attended by **more than 70 participants** (40 online and 30 in person), was thoughtfully designed to foster scientific exchange, intellectual engagement, and collaboration. It opened with an inaugural session that set a collaborative tone, followed by **six scientific sessions featuring 13 speakers**. Together, these talks highlighted advances in tectonics, seismicity, climate variability, and adaptation strategies, offering a rich platform for interdisciplinary dialogue.

Early-career scientists brought fresh perspectives and dynamic energy, underscoring the vital role of youth-led contributions. The concluding session synthesised the deliberations, capturing key insights and identifying future directions, while a warm acknowledgement was extended to all participants for their contributions and commitment to advancing scientific understanding.
Overall, the meeting advanced the theme "Earth's Changing Contours: The Interplay of Forces and Time," shaping an informative and thought-provoking exchange that opened new avenues for collaboration and knowledge sharing.

- **Scientific Sessions:** Featured 13 speakers, including eight invited lectures and five presentations by young researchers, providing a vibrant platform to showcase ongoing research, exchange innovative ideas, and foster interdisciplinary dialogue.

- **Young Minds:** Early-career scientists enriched the discussions with fresh perspectives, emphasizing the importance of youth-led contributions to Earth system science.

- **Closing Remarks:** The meeting concluded with reflections that captured the essence of the deliberations, highlighting key takeaways and future directions.

Introduction

The Word Academy of Sciences Central & South Asia Regional Partner (TWAS CASAREP), Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru, India, organized a Young Scientists' Meeting on "Earth's Changing Contours: The Interplay of Forces and Time" from 27–29 August 2025 at the Nevill Mott Hall, JNCASR. This meeting was convened in celebration of the 2025 International Year of Glaciers' Preservation, reflecting the global urgency to understand Earth's dynamic systems in the face of accelerating changes. The gathering brought together early-career researchers and established experts from across the world, creating a vibrant platform for scientific exchange and mentorship. Designed to foster interdisciplinary dialogue, the meeting focused on the intricate linkages between tectonics, climate, natural hazards, and human resilience. Participants engaged in lectures, presentations, and open discussions that highlighted the latest advances in Earth system sciences and the societal implications of climate variability, seismic hazards, and environmental transformation.

By convening voices from diverse regions and scientific domains, the meeting underscored TWAS CASAREP's mission to promote excellence in science, support young researchers, and strengthen collaborations. The dynamic interactions and cross-cultural perspectives that emerged during the sessions reaffirmed the importance of empowering the next generation of scientists to tackle the pressing challenges of our rapidly changing planet.

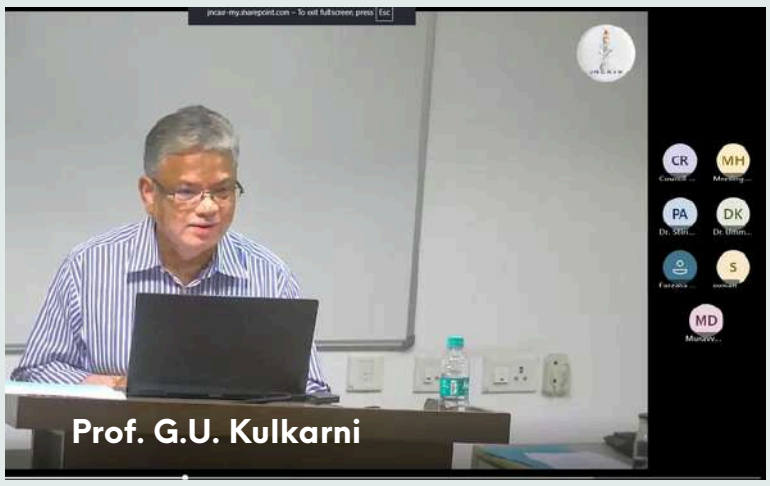
Participation Overview

The event witnessed participation, bringing together more than 70 attendees and speakers, including 40 online and 30 in person. The scientific program featured eight invited lectures delivered by distinguished scientists from India, Nepal, Pakistan, Poland, Türkiye, and the United States of America, including three eminent women scholars. A total of sixteen (16) young scientists were invited to participate in person from India, Kazakhstan, Nepal, and Uzbekistan, presenting their research and interacting with experts and peers. The meeting was marked by a notable presence of young women scientists, with fourteen (14) women among the in-person participants within the invited group of sixteen (16). Of the seven young researchers who presented their work, five were women, further enriching the discourse and highlighting the meeting's strong emphasis on gender inclusivity and diverse scientific perspectives.

Beyond the invited speakers and early-career researchers, the event attracted a broad and diverse international audience. A total of 70 registered participants joined from across academia, government, industry, and non-profit organizations, representing countries; Bangladesh, China, India, Indonesia, Iran, Italy, Kazakhstan, Nepal, Nigeria, Pakistan, the Philippines, South Africa, Sri Lanka, Tajikistan, Uganda, the United States, and Uzbekistan. Of these, 46 participants were women, underscoring the meeting's success in fostering gender-balanced participation. This event deepened the scientific breadth and interdisciplinarity of the discussions and brought cross-cultural perspectives to pressing challenges related to climate change, natural hazards, and Earth system dynamics.

Inaugural Session

The Young Scientists' Meeting on "Earth's Changing Contours: The Interplay of Forces and Time", organized by the TWAS Central & South Asia Regional Partner (TWAS CASAREP) at JNCASR, commenced on 27 August 2025 at 14:30 IST. Held in hybrid mode, the meeting convened eminent scientists, early-career researchers, and global participants to deliberate on the processes shaping Earth's surface through the interplay of tectonics, climate, and human influence.



In the presence of **Prof. V. Krishnan,** TWAS Member and Former President of JNCASR, the Welcome and Opening Remarks were delivered by **Prof. G.U. Kulkarni,** TWAS Member & Coordinator, TWAS CASAREP, JNCASR. Extending a warm welcome to the speakers, and all participants joined in person and online, Prof. Kulkarni acknowledged the distinguished presence of representatives from the TWAS Regional Office, Trieste, Italy. In his address, Prof. Kulkarni underscored the significance of understanding Earth's dynamic systems in the context of accelerating environmental change. He highlighted the interconnected roles of the deep Earth, oceans, atmosphere, and human activity in shaping planetary landscapes, while urging young scientists to engage actively in the deliberations and contribute to advancing future discoveries.



This was followed by **Prof. Umesh Waghmare, President of JNCASR,** who formally welcomed participants on behalf of the host institution. He acknowledged the visionary contributions of former JNCASR President, Prof. V. Krishnan, and reiterated the urgency of addressing the challenges posed by natural and anthropogenic changes to Earth systems.



Prof. Waghmare stressed that recurring earthquakes, floods, landslides, and the retreat of glaciers remind us of the fragility of the interconnected Earth system, reinforcing the timeliness of the meeting's theme. He noted that the meeting provides a valuable platform to integrate insights across tectonics, climate science, and societal impacts to build resilience and contribute to sustainable futures.

The opening session concluded with an overview of the program and the introduction of invited speakers by Dr. Jaishri Sanwal Bhatt, Research Scientist, Office of the Coordinator, TWAS-CASAREP, JNCASR. She extended a warm welcome to participants joining both onsite and online, thereby setting a collaborative tone for the scientific deliberations. The subsequent scientific sessions were chaired by Dr. Bhatt.



Dr. Jaishri Sanwal Bhatt

Scientific Session Highlights

27 August 2025

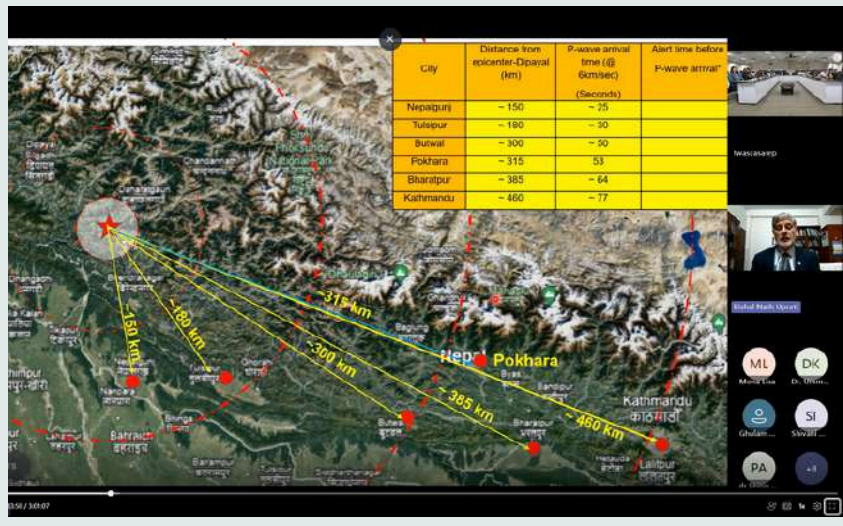
The first day of the meeting set a strong intellectual foundation with four distinguished lectures that explored diverse yet interconnected themes shaping South Asia's dynamic landscapes. Spanning tectonics, seismicity, climate change, and adaptation strategies, the talks offered a panoramic view of the region's vulnerabilities and resilience, linking Earth's deep processes with the surface environments and societies they affect. The day opened with a keynote by Prof. B. N. Upreti, TWAS Fellow from Nepal, which set the tone for the sessions that followed.

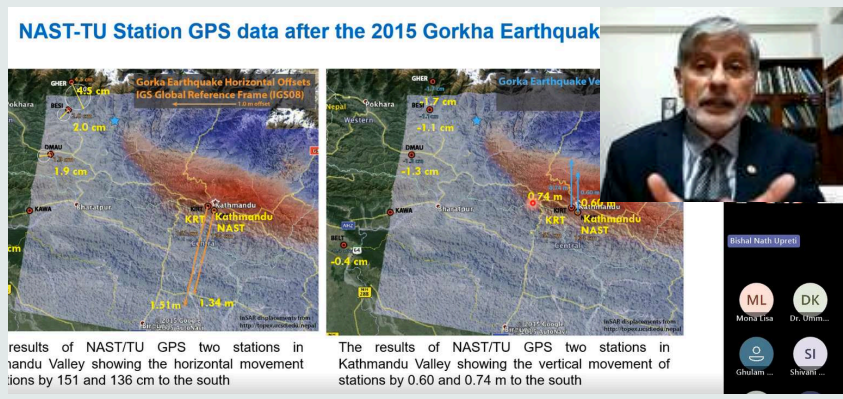




Prof. B.N. Upreti

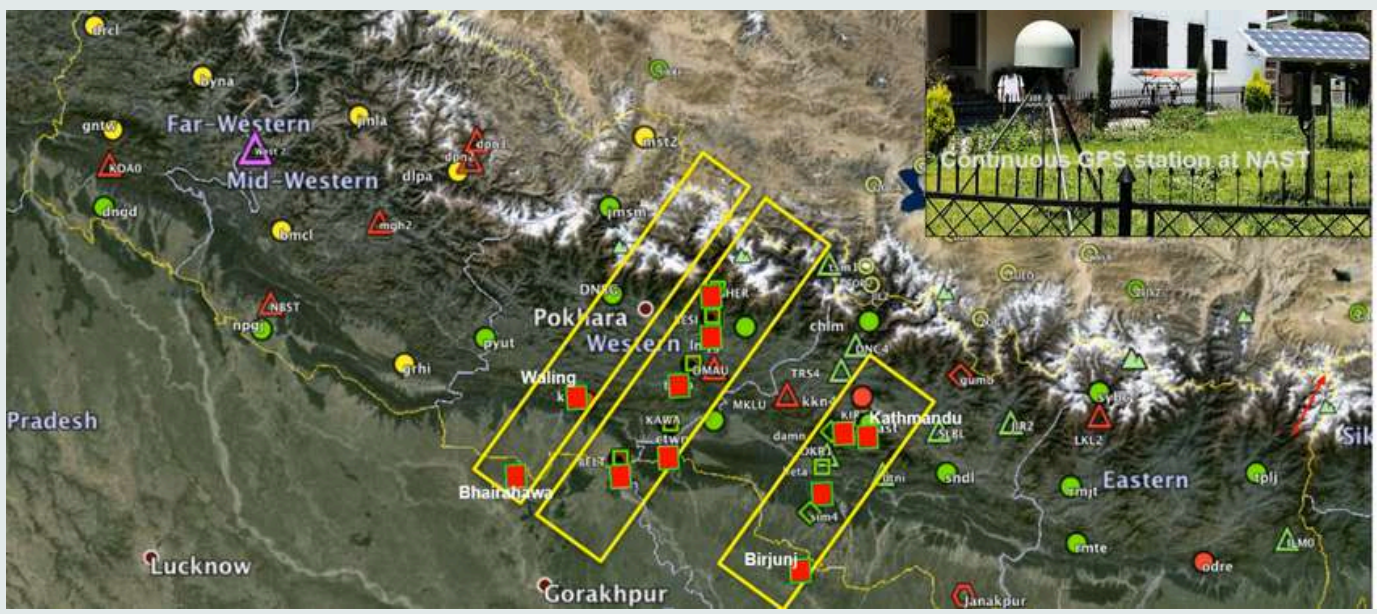
Prof. B.N. Upreti, Nepal Academy of Science & Technology, Kathmandu, Nepal presented an in-depth synthesis of advances in Himalayan seismotectonics, informed by nearly five decades of seismic and GNSS monitoring and deep seismic profiling. His lecture underscored the geometry of the Main Himalayan Thrust (MHT) and its central role in accommodating plate convergence. He drew attention to the Western Nepal Seismic Gap (last ruptured in 1505 AD) and the Eastern Nepal - Darjeeling - Sikkim Gap (quiescent for 800–1,300 years), both of which are capable of producing Mw 8^{+} megathrust earthquakes. He informed that such events would have catastrophic implications for densely populated and infrastructure poor regions across Nepal and northern India. Integrating paleoseismology, geodesy, and seismology, Prof. Upreti highlighted the locked nature of these segments, their potential for multi-segment ruptures, and the urgent need for preparedness. His talk emphasized that while science has advanced in identifying seismic gaps and strain accumulation, effective hazard mitigation remains a pressing challenge for the region.



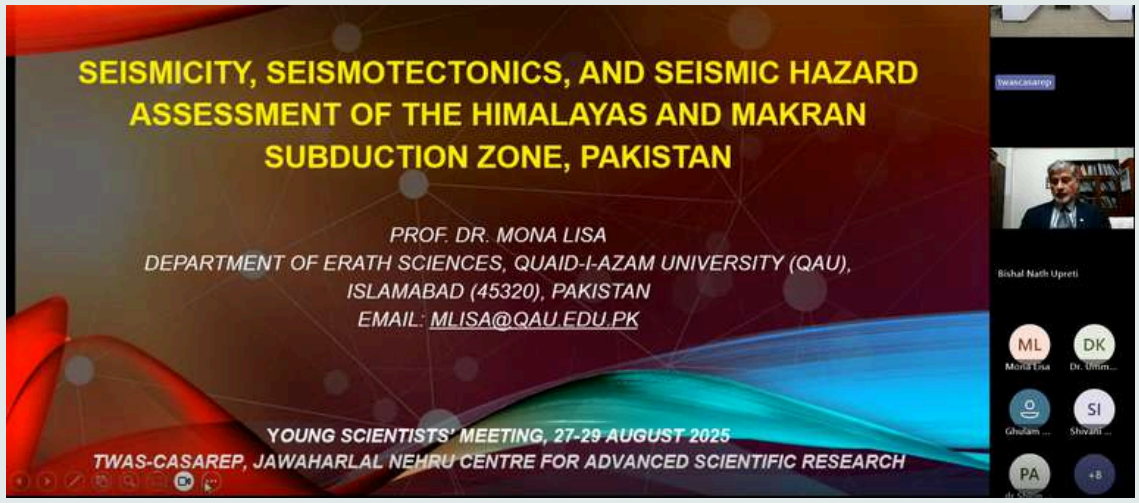


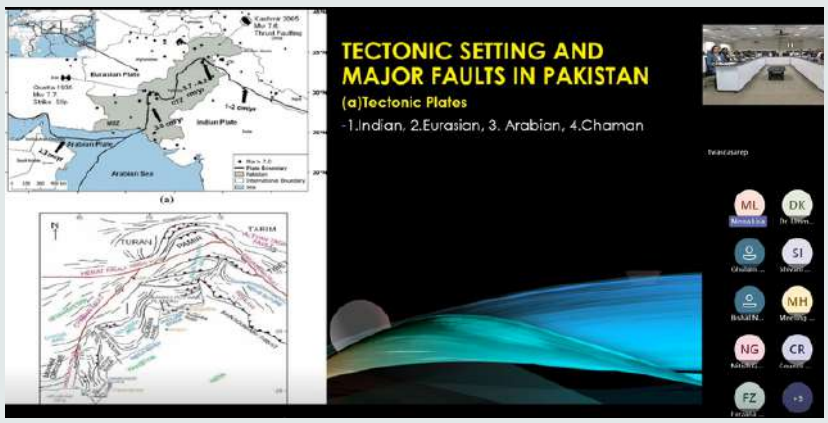
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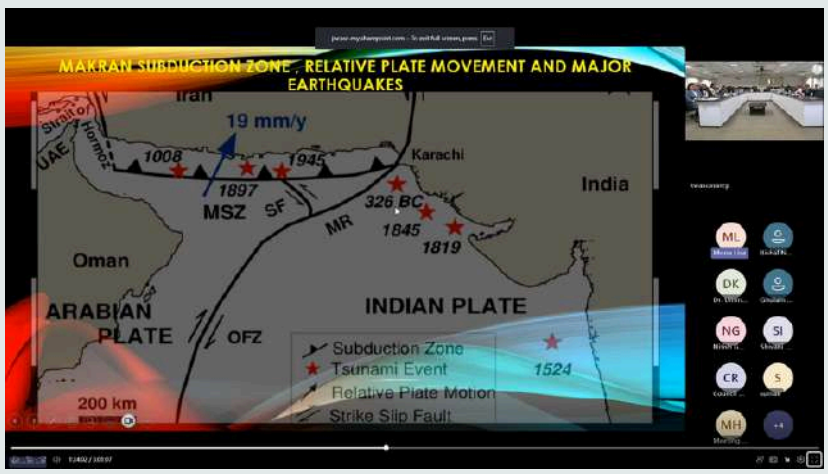
The results of NAST/TU GPS two stations in Kathmandu Valley showing the vertical movement of stations by 0.60 and 0.74 m to the south







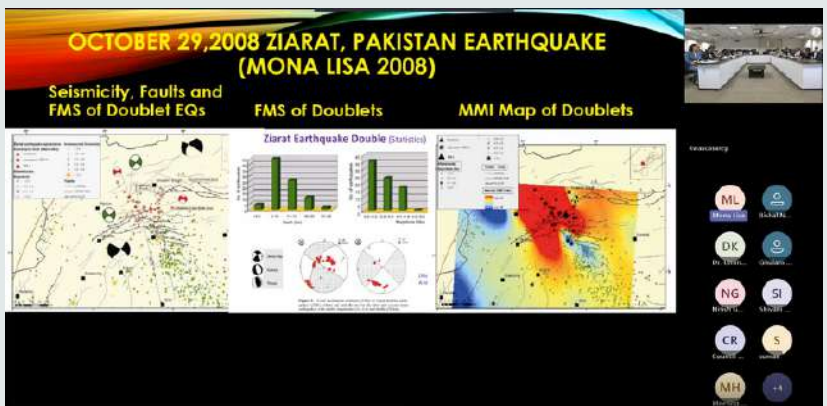


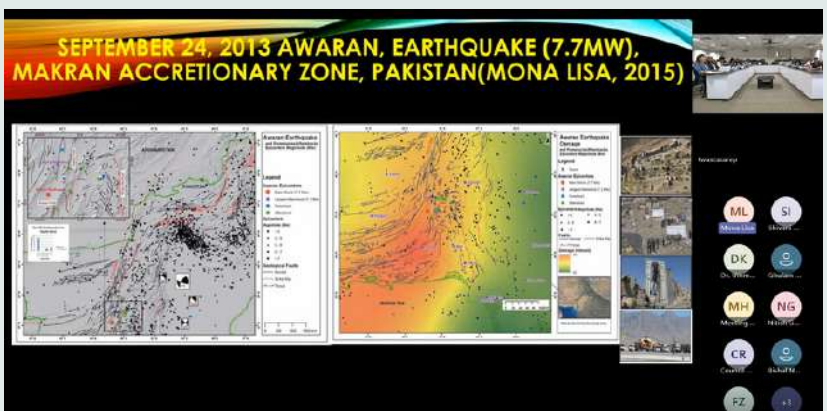


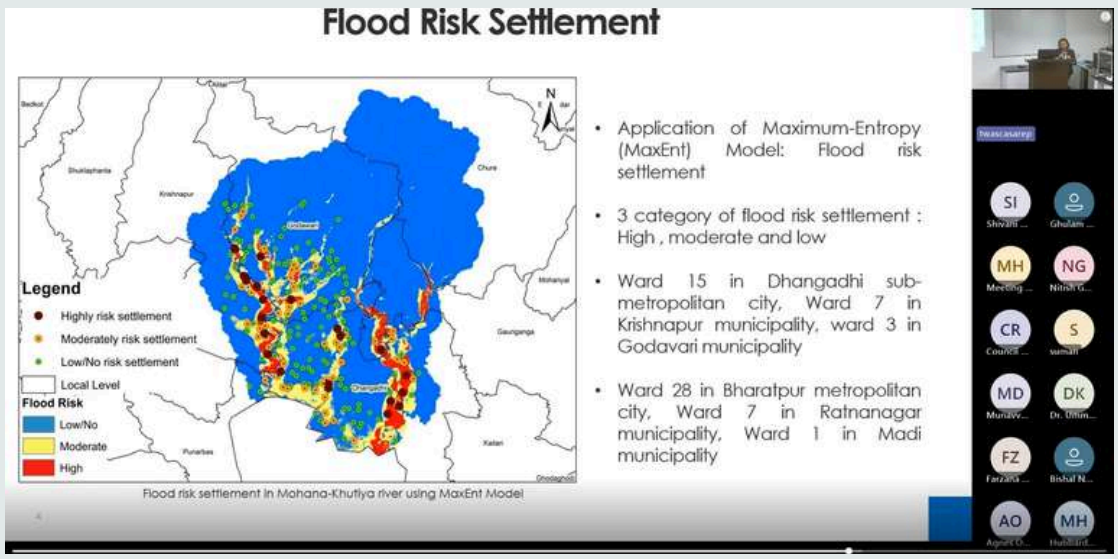
Prof. Mona Lisa, Department of Earth Sciences, Quaid-i-Azam University, Islamabad, Pakistan discussed the dual seismic challenges faced by Pakistan: the Himalayan collision zone and the Makran Subduction Zone (MSZ). She highlighted how the ongoing collision of the Indian and Eurasian plates continues to drive Himalayan uplift, crustal deformation, and frequent large earthquakes, with locked segments of the Main Himalayan Thrust (MHT) posing a significant risk of Mw 8^{+} events. Integrating historical earthquakes, GPS data, and fault geometries, she emphasized the vulnerability of densely populated urban centers such as Islamabad and Muzaffarabad, where Peak Ground Acceleration (PGA) values can exceed 0.4–0.6g.

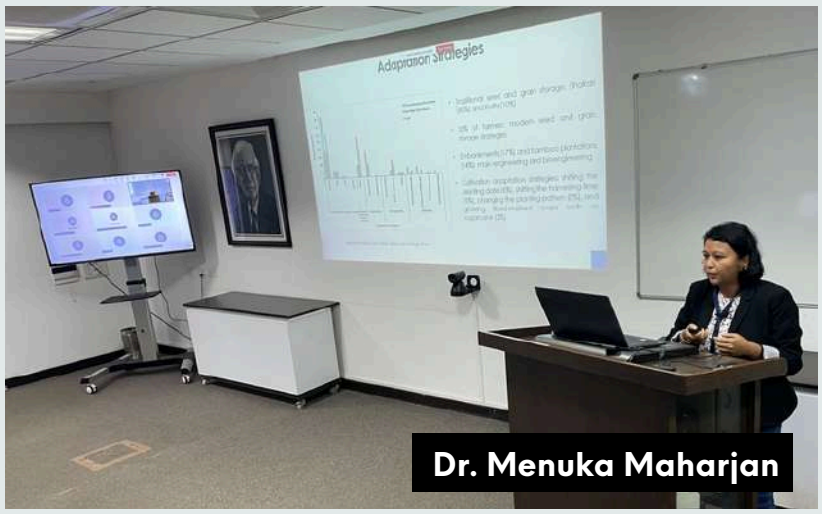
Turning to the Makran Subduction Zone, she described its unique seismic character, combining megathrust earthquakes and slow-slip events. The devastating 1945 Mw 8.1 earthquake and tsunami underscored the region's hazards, particularly for coastal cities like Karachi, where offshore seismicity and low-angle subduction amplify tsunami risk. Probabilistic seismic hazard analyses indicate PGA values of 0.1–0.3g for a 475-year return period, alongside tsunami wave heights of up to 15 meters in worst-case scenarios.

Prof. Mona Lisa concluded that while the Himalaya is dominated by shallow crustal seismicity and the Makran by offshore subduction-related hazards, both regions demand enhanced monitoring, stricter building codes, and disaster preparedness to mitigate risks. Her lecture emphasized the urgent need for integrated hazard assessment and resilience strategies in South Asia's tectonically dynamic landscapes.



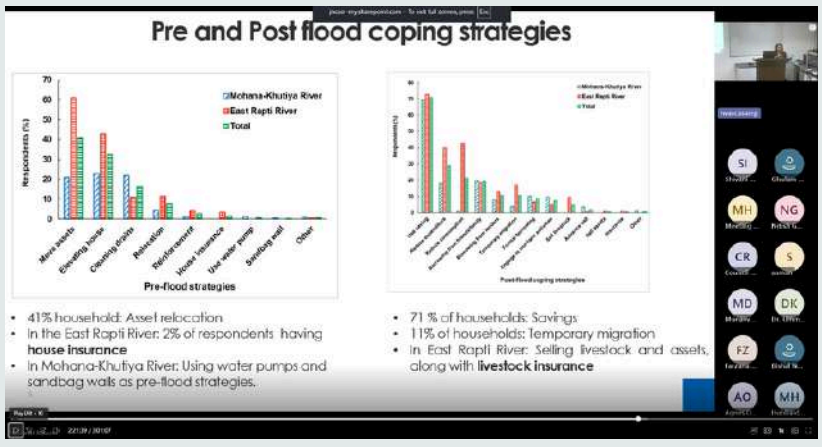






Dr. Menuka Maharjan, a young scientist from the School of Forestry and Natural Resource Management, Tribhuvan University, Nepal shifting focus from tectonics to human resilience, Dr. Maharjan presented findings from household surveys in flood-prone river basins of the Chure–Terai Region. Her research revealed diverse pre- and post-flood adaptation strategies, including relocation of assets (41%), savings mobilization (71%), temporary migration (11%), as well as seed storage, cultivation modifications, and bioengineering interventions.

A Multivariate Probit analysis highlighted the influence of socioeconomic, farm, and institutional factors, such as education, proximity to roads, irrigation access, and credit availability on adaptation choices. Importantly, despite high awareness of early warning systems, no direct correlation with adaptation practices was observed, pointing to gaps in translating awareness into action. Her talk underscored the need for policy frameworks that align local realities with adaptation support, ensuring food and livelihood security in flood-vulnerable communities.







Prof. Mary S. Hubbard, Professor Emerita, Montana State University, USA delivered an engaging lecture on the coupling of tectonics and climate in sculpting the Himalaya. She traced the orogen's evolution since the India - Asia collision (~50–60 Ma), highlighting how fault systems, monsoonal precipitation, and glacial processes together sustain high relief. She emphasized feedback loops, wherein tectonic uplift drives glaciation and erosion, while climate warming accelerates glacier retreat, triggering landslides, floods, and cascading hazards.

Her presentation vividly illustrated the vulnerability of Himalayan landscapes to combined tectonic and climatic forces. A short video from her Everest expedition, featured by National Geographic, further showcased ongoing research on glacial lakes and their role in paleoclimatic reconstruction. The first day concluded with an interactive discussion, where young participants actively engaged with Prof. Mary S. Hubbard. Questions revolved around improving hazard prediction, integrating paleoclimate records with seismic studies, and enhancing local adaptation measures. The dialogue reflected the meeting's core aim: to foster cross-disciplinary exchange between experienced scientists and early-career researchers.





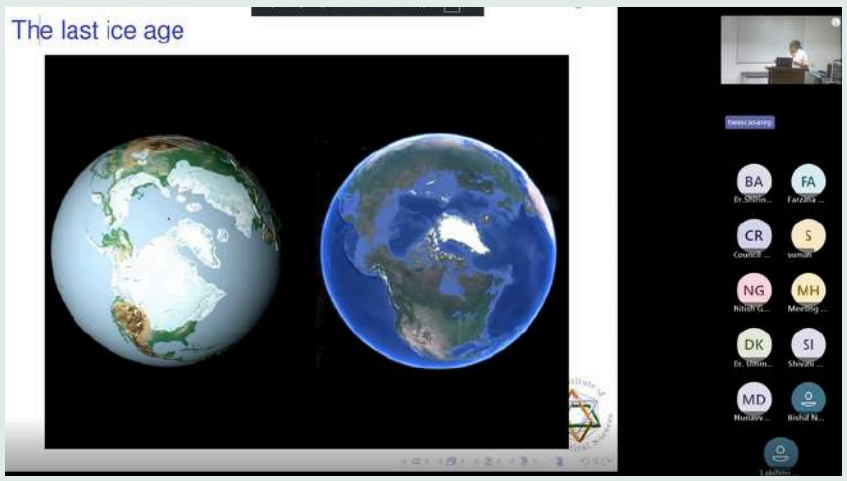


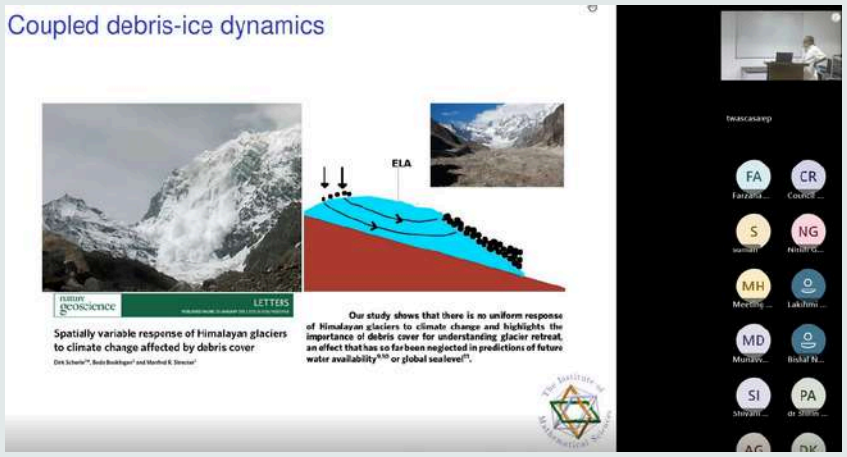


28 August 2025




Prof. Ramachandran Shankar







The second day of the meeting opened with an illuminating lecture by **Prof. Ramachandran Shankar**, Institute of Mathematical Sciences, Chennai, on the dynamics of the changing cryosphere. Using striking field photographs and clear visual evidence of glacier retreat, he demonstrated the increasing vulnerability of the cryosphere under ongoing climate change.

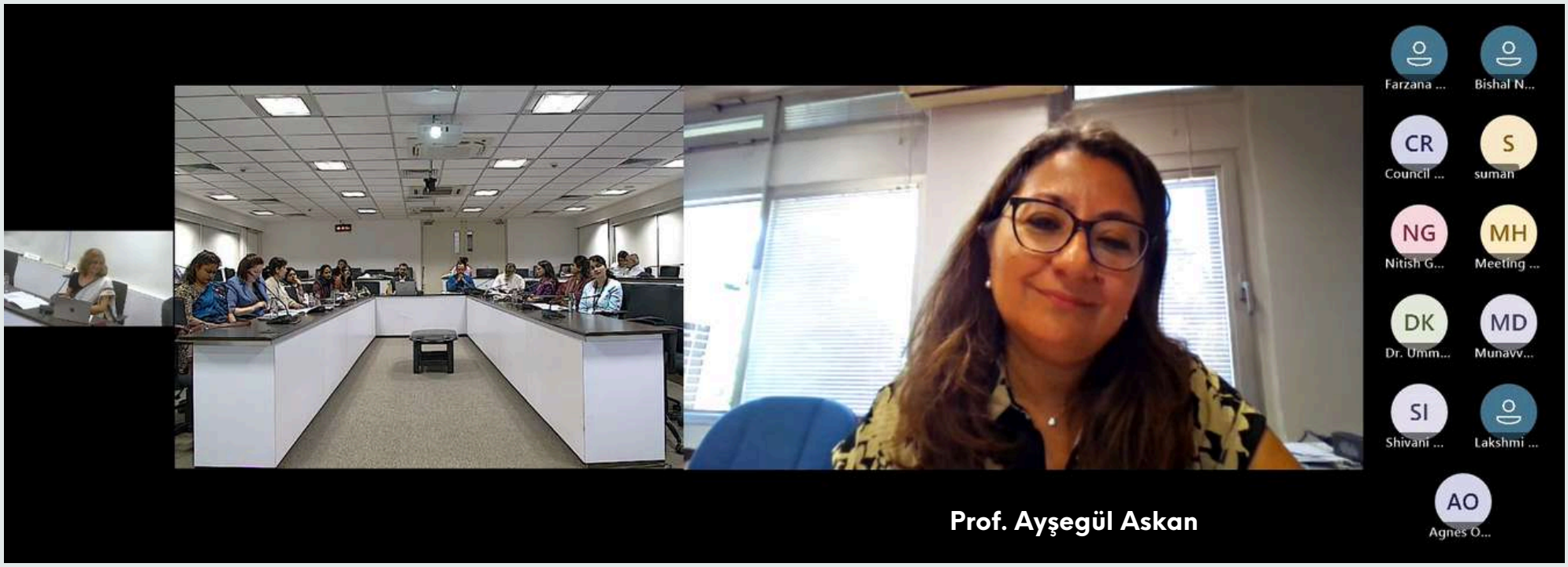
Prof. Shankar emphasized that while Earth has undergone continuous transformations since its formation, the current pace of change is both unprecedented and alarming. Framing his lecture around three central questions—Where is Earth's ice today? Where was it in the past, and how do we know that? And where will it be in the near future?—he provided a comprehensive overview of cryospheric science.

Drawing on geomorphological evidence, he discussed past ice ages and their reconstruction through landforms and deposits, and explained the role of Milankovitch cycles in driving glacial–interglacial rhythms. He explained that even small variations in Earth's orbital parameters and axial tilt modify the distribution of incoming solar radiation, which in turn governs the advance and retreat of ice sheets over geological timescales.

He concluded by highlighting the critical implications of modern ice loss, particularly its contribution to sea-level rise and its impact on river discharge, emphasizing the cascading consequences for ecosystems, water resources, and human societies.





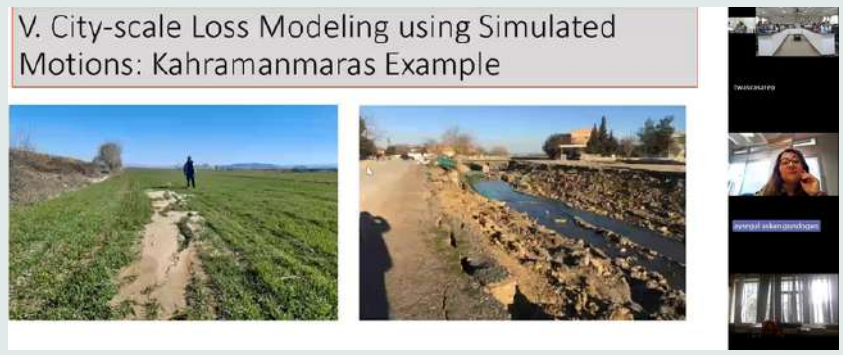


Prof. Ayşegül Askan

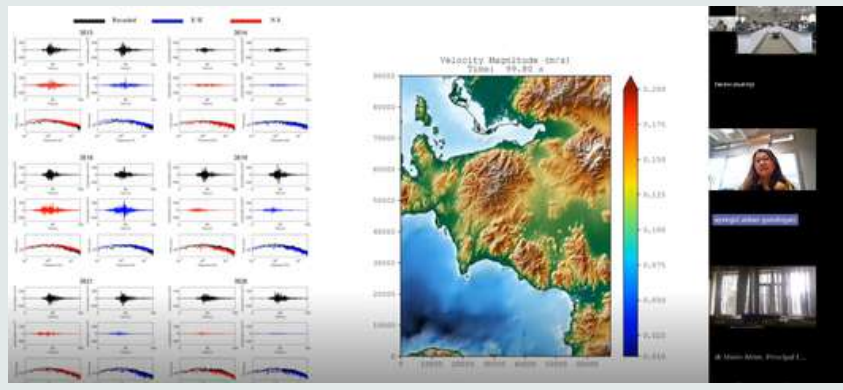
The second lecture of the meeting was delivered by **Prof. Ayşegül Askan,** Middle East Technical University, Ankara, Türkiye, on Recent Large Earthquakes, Numerical Simulations, and Urban Seismic Resilience in Türkiye.

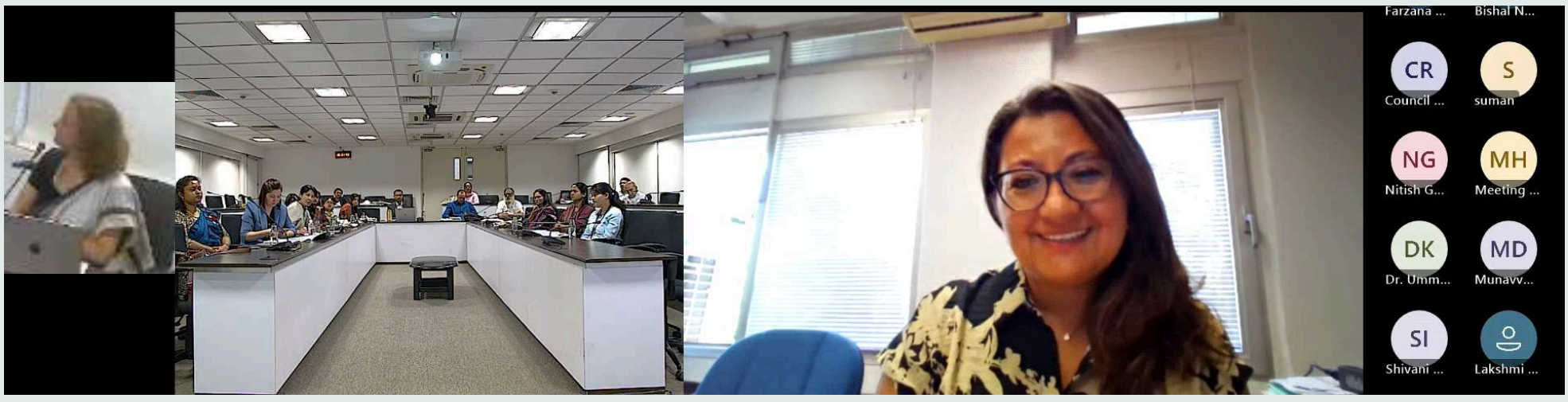


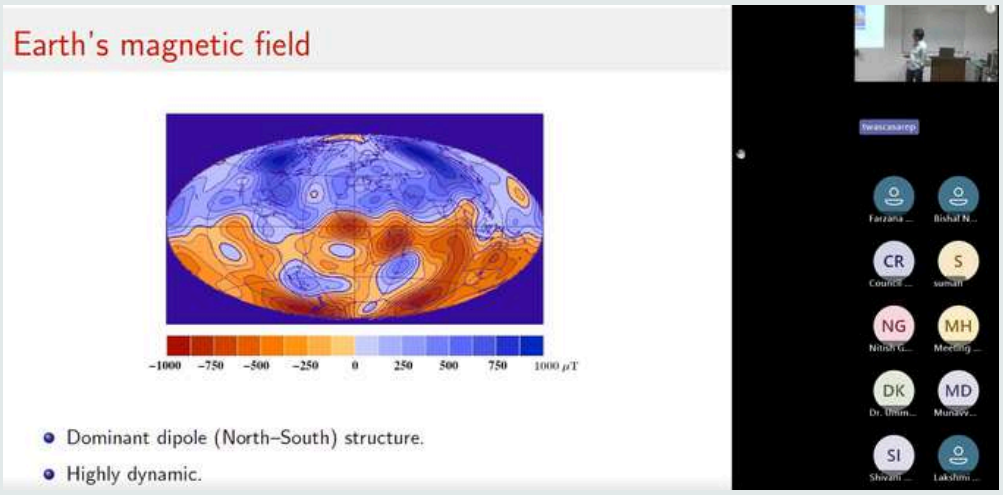
She explained that Türkiye, situated in a tectonically active zone, faces recurrent large earthquakes every few years. Her presentation underscored the importance of seismic risk modeling and mitigation, which require collaboration across geophysics, earthquake engineering, urban planning, and even insurance sectors.



Prof. Askan highlighted the increasing role of simulated ground motions in modern earthquake engineering, enabled by advances in computational capabilities and site characterization techniques. Such simulations not only complement past seismic records but also provide site - specific datasets, offering valuable insights for urban seismic resilience in Türkiye and other earthquake - prone regions worldwide.

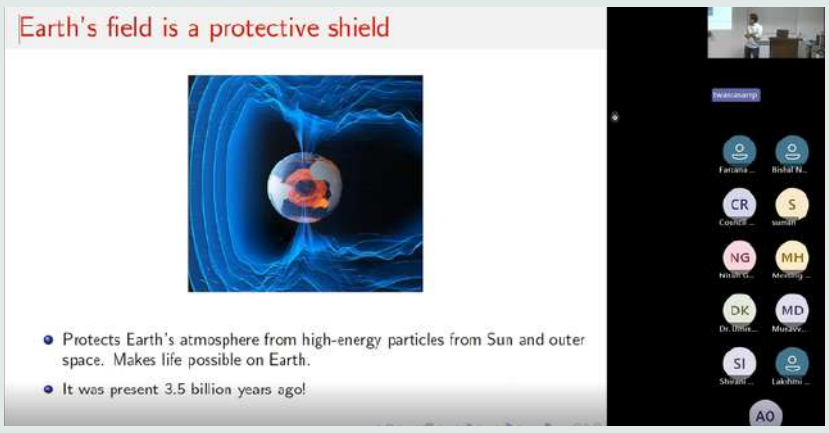








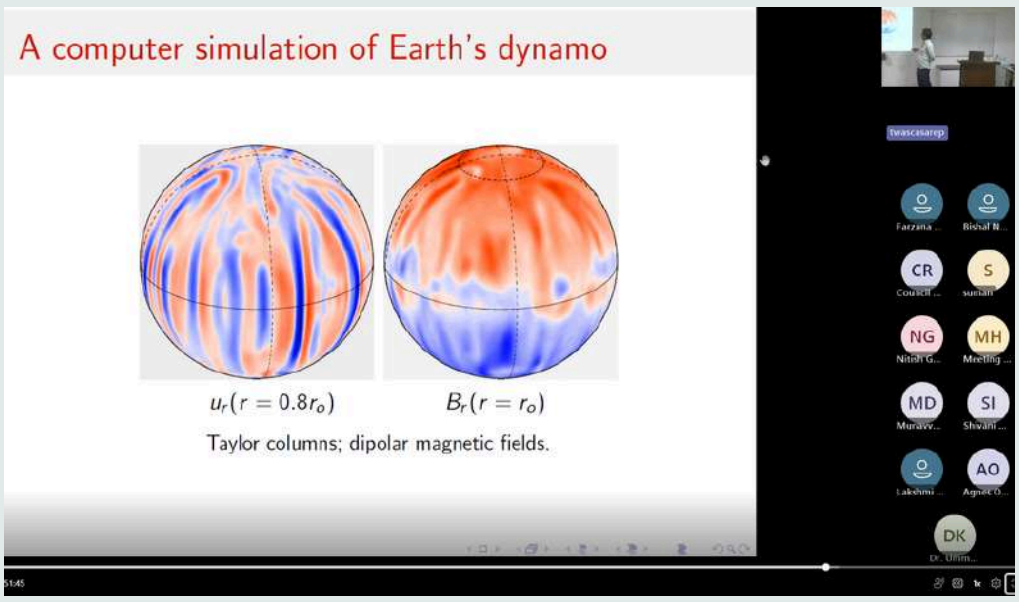
The third lecture was delivered by **Prof. Binod Sreenivasan,** Centre for Earth Sciences, Indian Institute of Science, Bengaluru, on "The Earth's Magnetic Field and Its Origins." Guiding the audience into Earth's deep interior, he explored the mechanisms that sustain the planet's magnetic field, which serves as a vital shield against high-energy solar and cosmic radiation.



Prof. Sreenivasan traced the history of geomagnetic variability, including polarity reversals, the most recent of which occurred about 780,000 years ago preserved as distinctive signatures in volcanic rocks and sedimentary archives. He outlined how planetary differentiation shaped Earth's layered structure and why the study of planetary magnetism provides key insights into planetary evolution and habitability.



Central to his talk was the geodynamo process, driven by convection in the liquid outer core and explained through the framework of magnetohydrodynamics (MHD). This process underpins our present understanding of the generation and variability of Earth's magnetic field. His lecture highlighted significant advances in deciphering this complex planetary phenomenon and underscored its profound implications for both Earth system science and the protection of life on our planet.



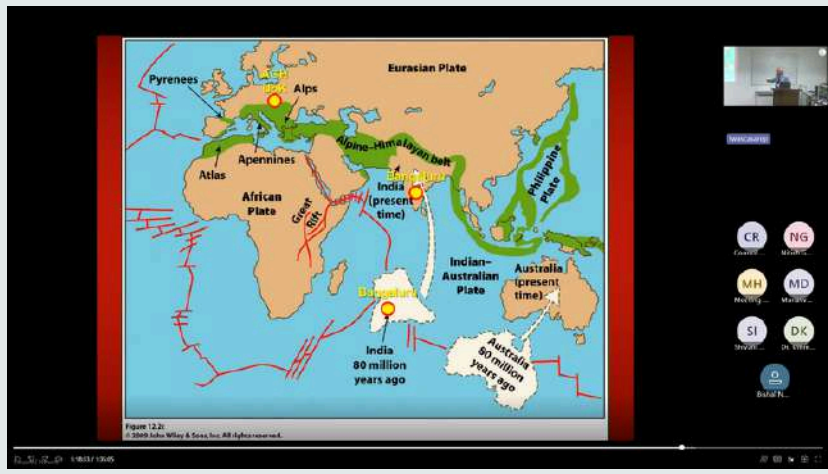






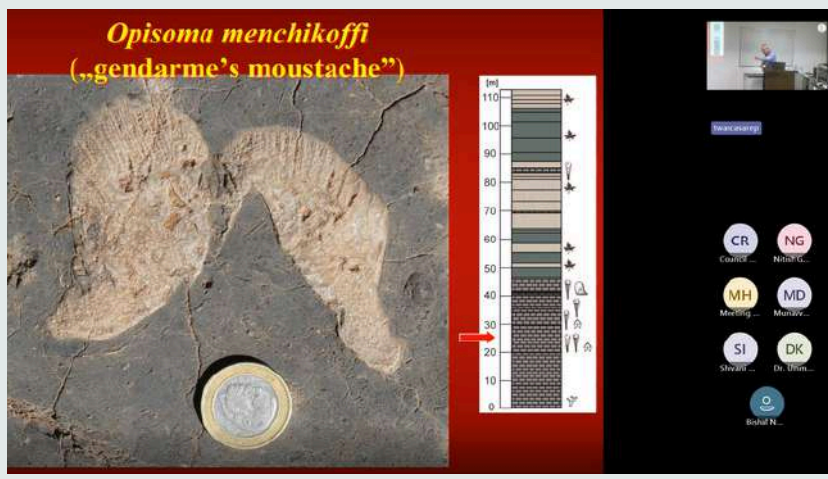
Prof. Michał Krobicki

Prof. Michał Krobicki delivered an engaging lecture on the Panjal Traps and their significance in understanding Early Jurassic paleogeography and faunal migration. Spanning ~10,000 km^2 across the Kashmir Valley, Pir Panjal, and Zanskar ranges, the Panjal Traps preserve thick volcanic sequences that record the transition from the Permian to the Triassic. At Guryul Ravine, basaltic pillow lavas, peperites, and interbedded limestones provide valuable insights into submarine volcanism and its interaction with marine environments, while radiometric dating places these events in the Early Permian (~289 Ma).



He highlighted the importance of peperites formed when basalt intrudes into unconsolidated carbonate mud, as key markers of syn-volcanic processes, useful for correlating volcanic and fossil records across the Himalaya and beyond. Additional exposures in Zanskar, with pillow lavas and pāhoehoe flows, reveal volcanic activity tied to the rifting and opening of the Neotethys Ocean. Prof. Krobicki also discussed the widespread appearance of Lithiotis-type bivalve buildups during the Early Jurassic. These giant bivalves rapidly colonized shallow-marine carbonates across the Tethys, Himalaya, and even into the Americas, illustrating both ecological recovery after mass extinction and the role of ocean circulation in facilitating faunal dispersal.





His synthesis emphasized how the Himalayan record provides a critical window into the interplay of volcanism, extinction recovery, and paleogeographic connectivity during the breakup of Pangea.

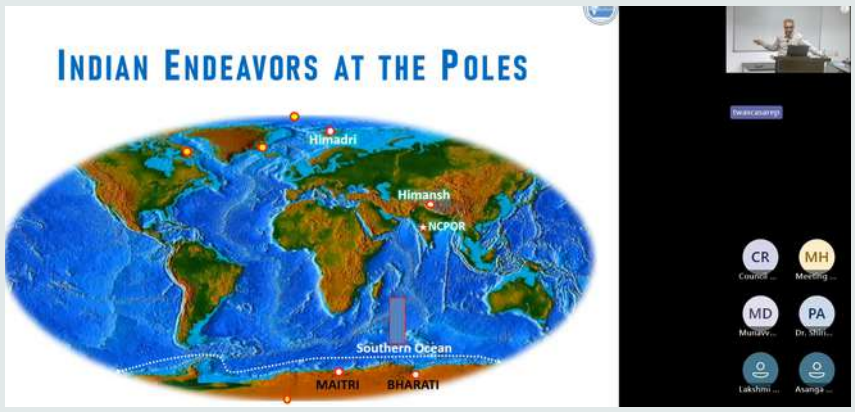


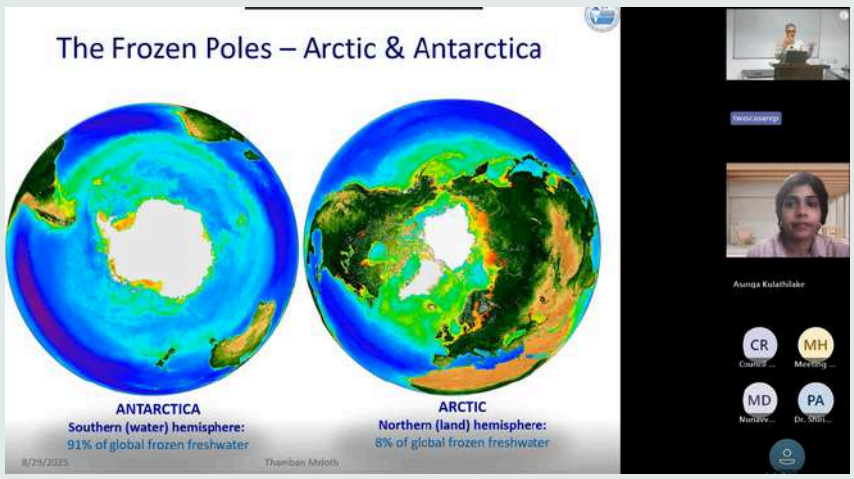


29 August 2025



The last day of the meeting commenced with an invited lecture by **Prof. Thamban Meloth**, National Centre for Polar and Ocean Research (NCPOR), Goa, titled "Exploring Poles in a Changing World – New Frontiers and Indian Endeavours." Prof. Meloth guided the audience across the Arctic, Antarctic, and the "Third Pole" – the Himalaya, illustrating how these cryospheric regions act as critical sentinels of climate change.



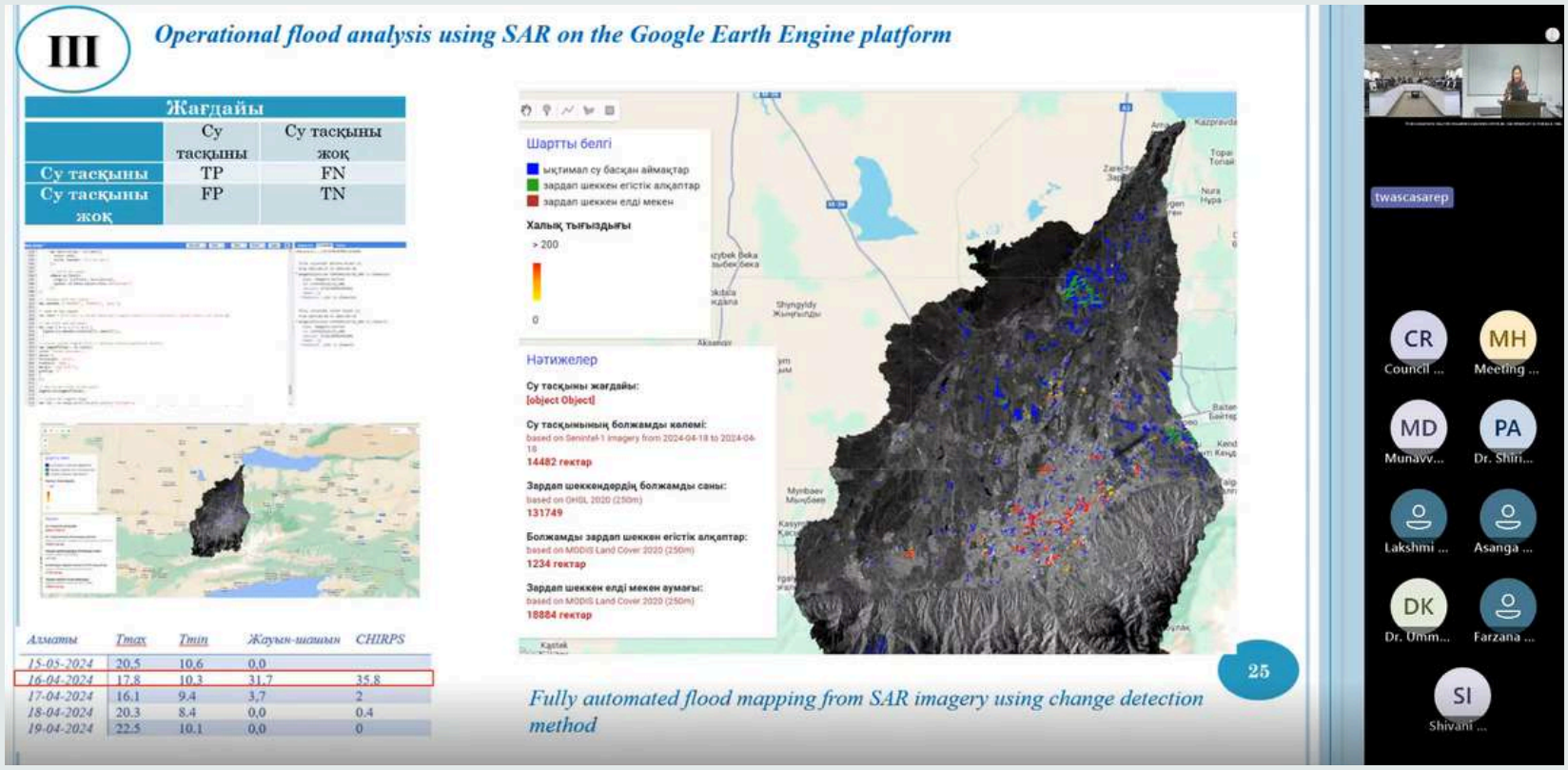


Prof. Thamban Meloth explained the disproportionate warming at the poles, two to four times faster than the global average due to polar amplification and highlighted its cascading consequences for sea-level rise, extreme weather, food security, ecological stability, and methane release from thawing permafrost. He also reflected on India's significant contributions to polar science, noting the country's over four decades of Antarctic exploration with two permanent stations, and its expanding Arctic program since 2007 with a base in Svalbard and field activities across the Canadian High Arctic, Greenland, and the Arctic Ocean. Prof. Meloth underscored that while the poles may seem distant from tropical nations like India, polar–tropical teleconnections critically influence monsoon systems, ocean circulation, and global climate patterns. His lecture called attention to the need for international collaboration in exploring these fragile yet globally connected regions.



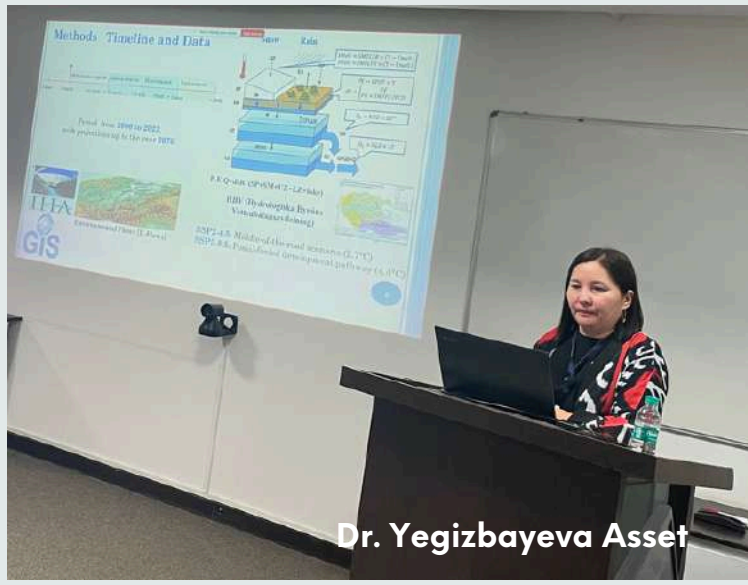


Following this keynote, the session transitioned to presentations by young scientists from across the region, each contributing fresh insights into the impacts of climate change on water resources, glaciers, biodiversity, and past climate variability.

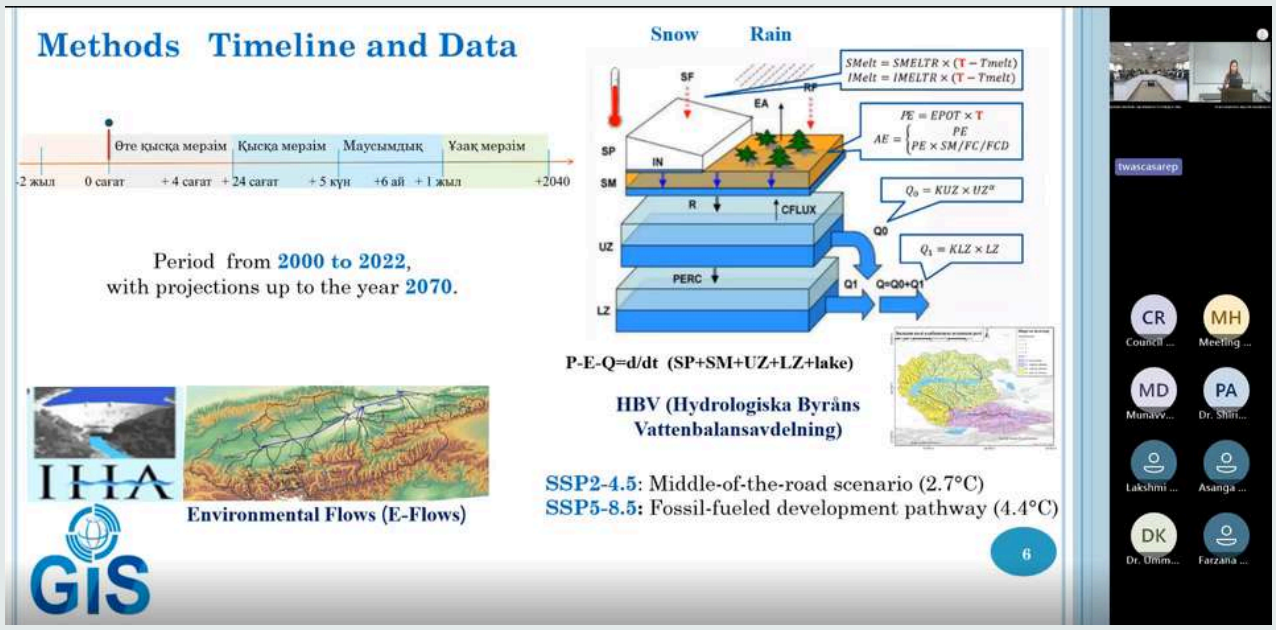


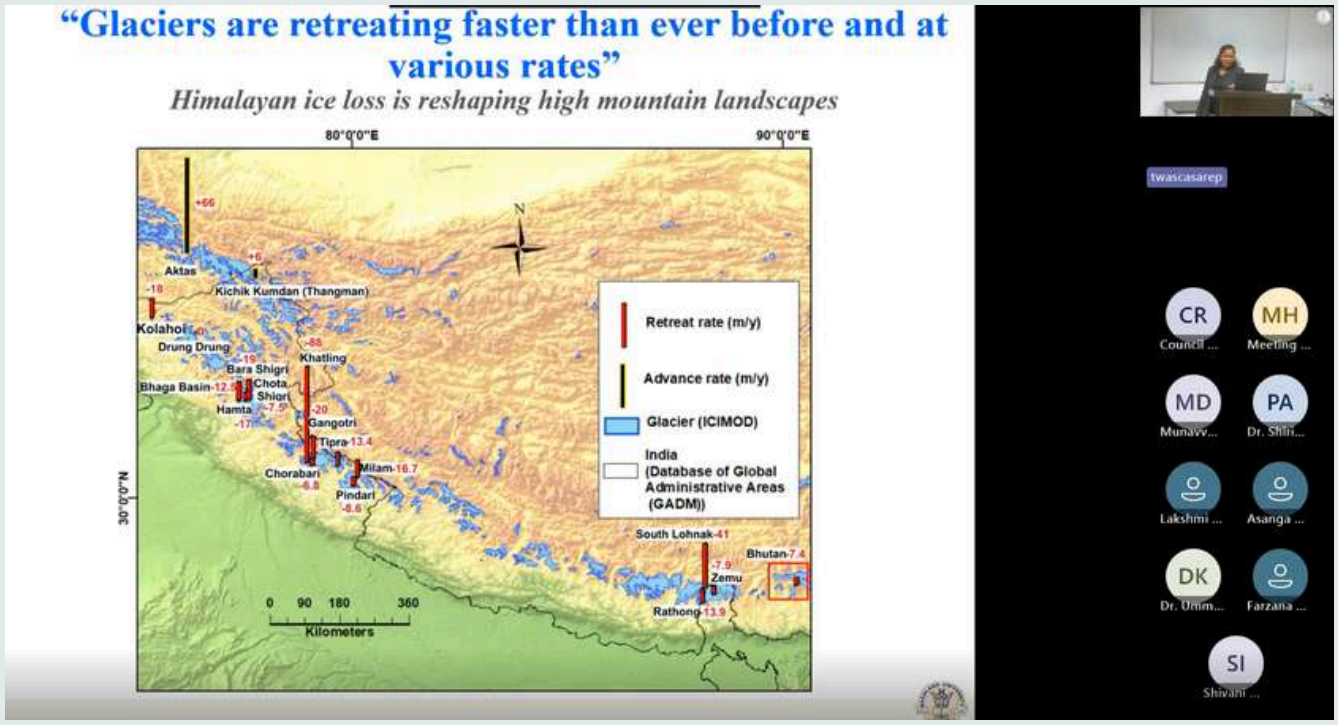
Dr. Yegizbayeva Asset, National Center of Space Research and Technology, Kazakhstan, presented "Geospatial Technologies for River Flow Modeling and Water Resource Management under Climate Change:

A Case Study of the Lake Balkhash Basin." She demonstrated how the integration of remote sensing, GIS, hydrological modelling, and machine learning provides powerful tools for predicting streamflow, assessing drought and flood risks, and planning sustainable water management in transboundary basins, while emphasising the necessity of international cooperation between Kazakhstan and China.



Dr. Yegizbayeva Asset







Dr. Manasi Debnath, School of Sciences, Nagaland University, presented her study on glacial lake dynamics in the Lachung Basin, Sikkim, Eastern Himalaya, with a particular focus on potentially dangerous glacial lakes (PDGLs). Using multi-decadal satellite imagery (1974–2023), she reported a substantial increase in both the number and area of glacial lakes, closely linked to accelerated deglaciation.

Her findings highlighted the rapid expansion of high-risk lakes such as those at the Tenbawa and Illibu Khangse glaciers, including evidence of an unreported moraine-dammed lake breach in 2023.

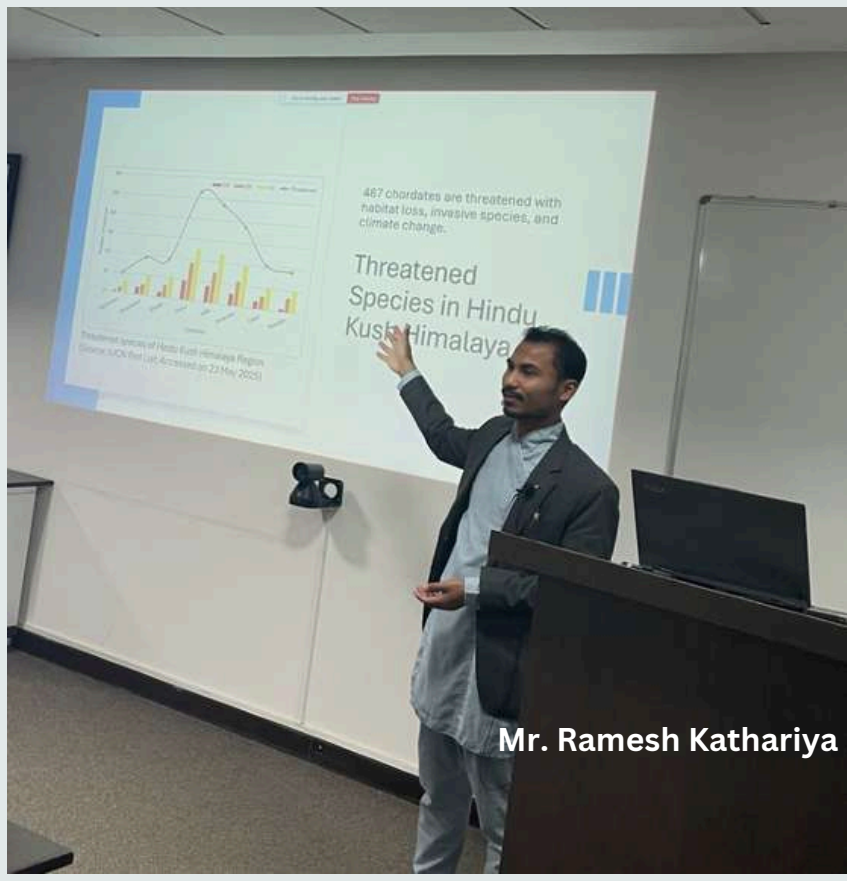
Through Analytical Hierarchy Process (AHP) analysis, she classified 24 PDGLs, with nearly 88% falling into medium to very high-risk categories. She stressed the urgency of detailed surveys, continuous monitoring, and proactive risk mitigation, cautioning that even small glacial lakes have the potential to trigger cascading hazards downstream.







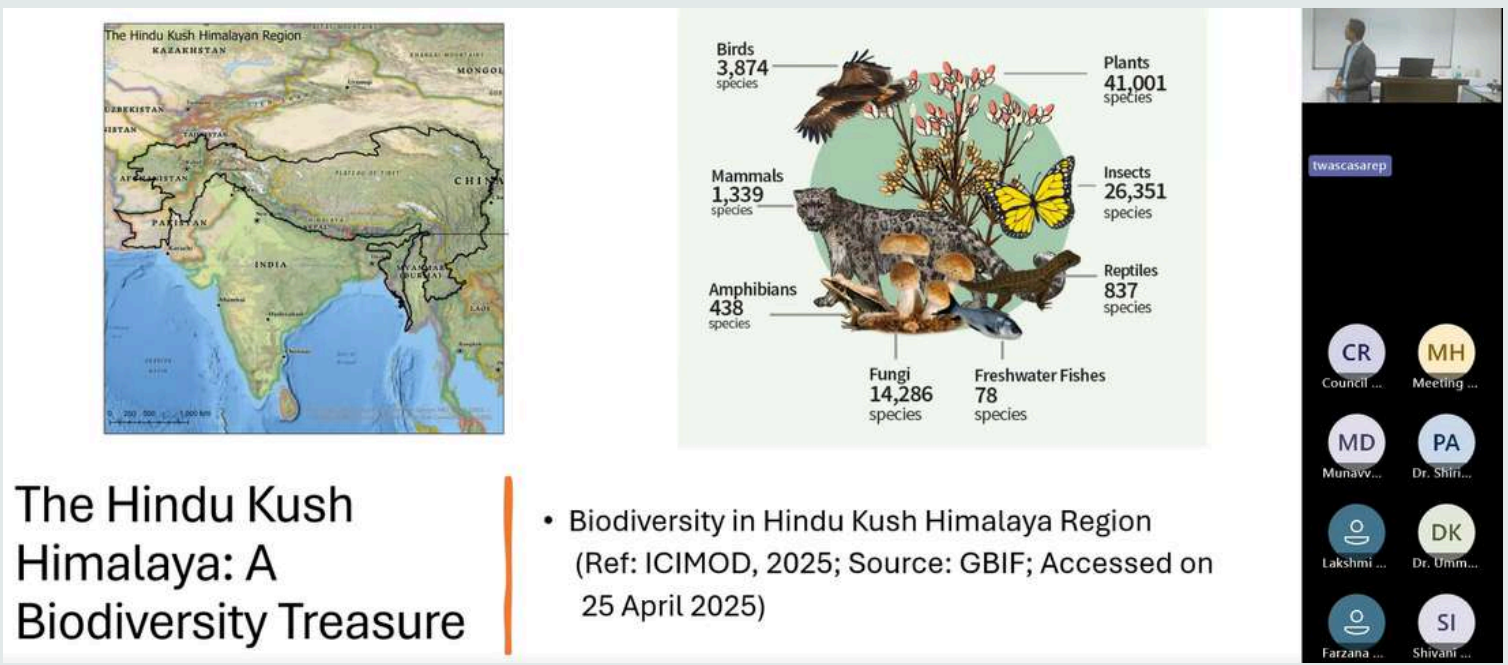
Mr. Ramesh Kathariya, International Centre for Integrated Mountain Development (ICIMOD), Nepal, discussed "The Fate of Biodiversity in a Changing Climate", focusing on the fragile ecosystems of the Himalaya, a global biodiversity hotspot. He highlighted that 487 species of chordates are threatened by the combined impacts of habitat degradation, invasive species, and climate change.

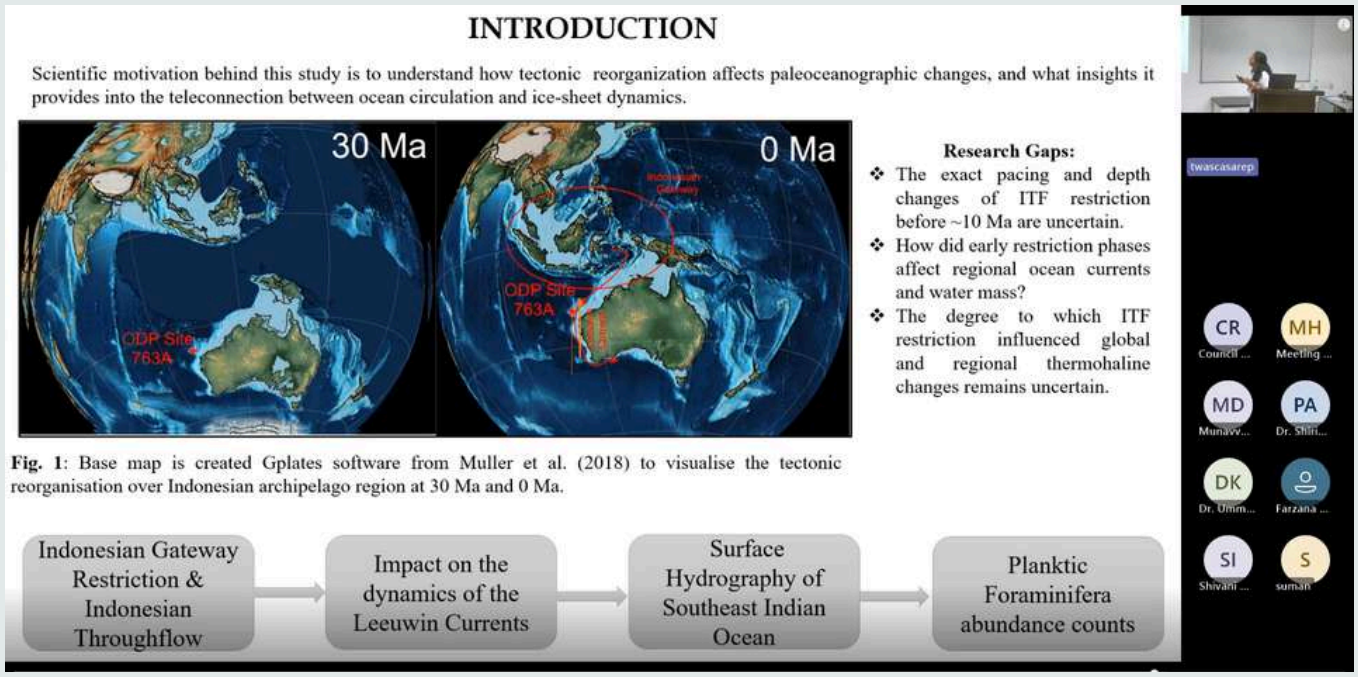


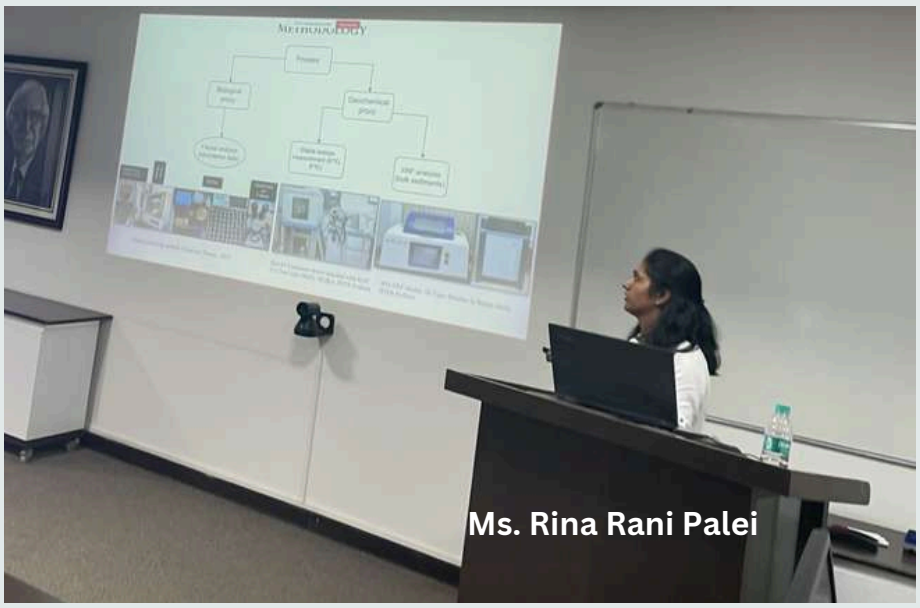
Mr. Ramesh Kathariya

Using examples of the Snow Leopard (Panthera uncia), Common Leopard (Panthera pardus), and Royle's Pika (Ochotona roylii), he showed how shifting habitats, glacial retreat, and rising temperatures are intensifying interspecies competition, human-wildlife conflicts, and ecosystem disruptions. The Royle's Pika, in particular, emerged as a sensitive bioindicator, vulnerable not only to gradual warming but also to unpredictable snowfall that undermines its winter survival.

He stressed the urgent need for integrated conservation strategies that link species protection, habitat management, and community resilience. His lecture also connected with the International Year of Glacier Preservation (IYGP) by underlining the biodiversity challenges in glaciated mountain ecosystems.

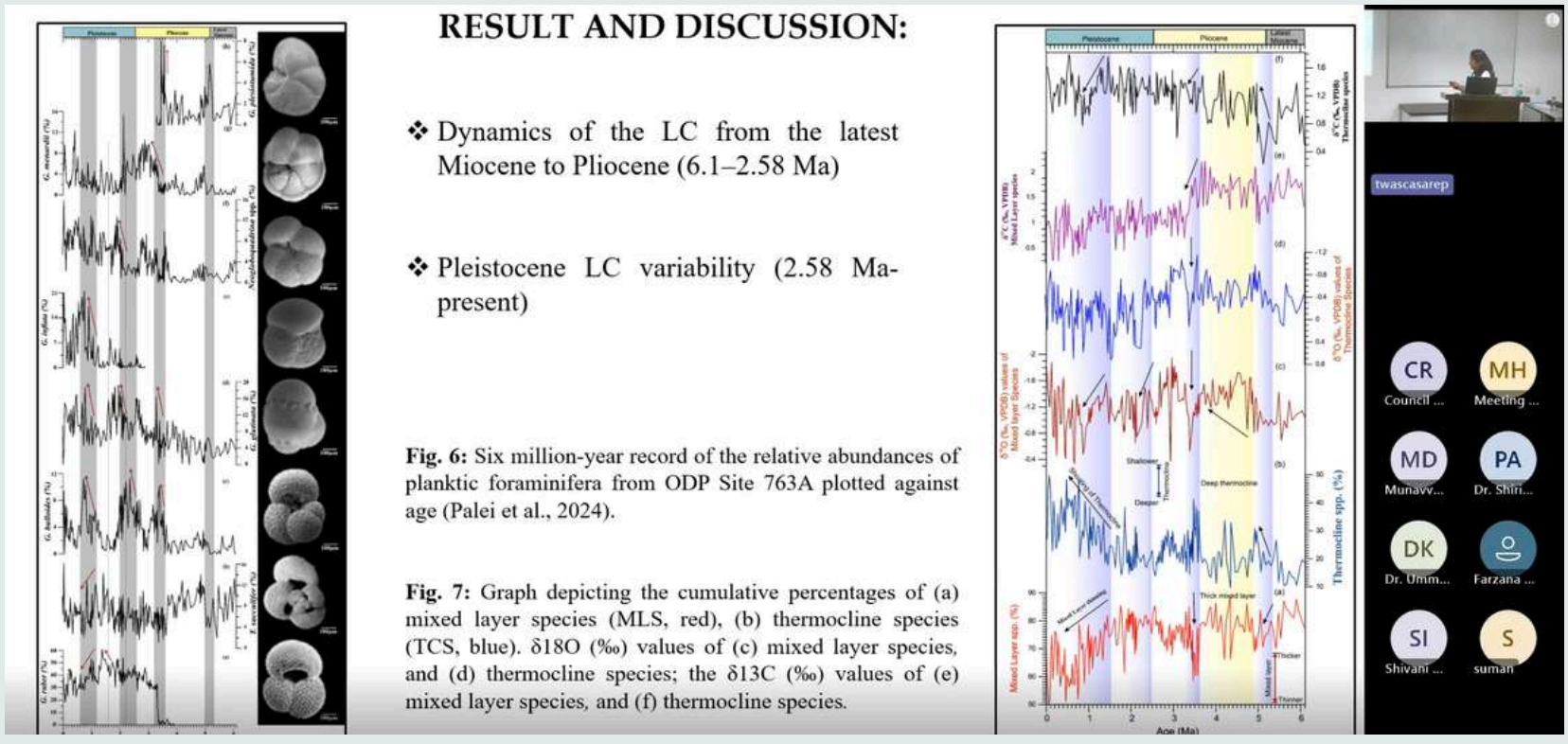


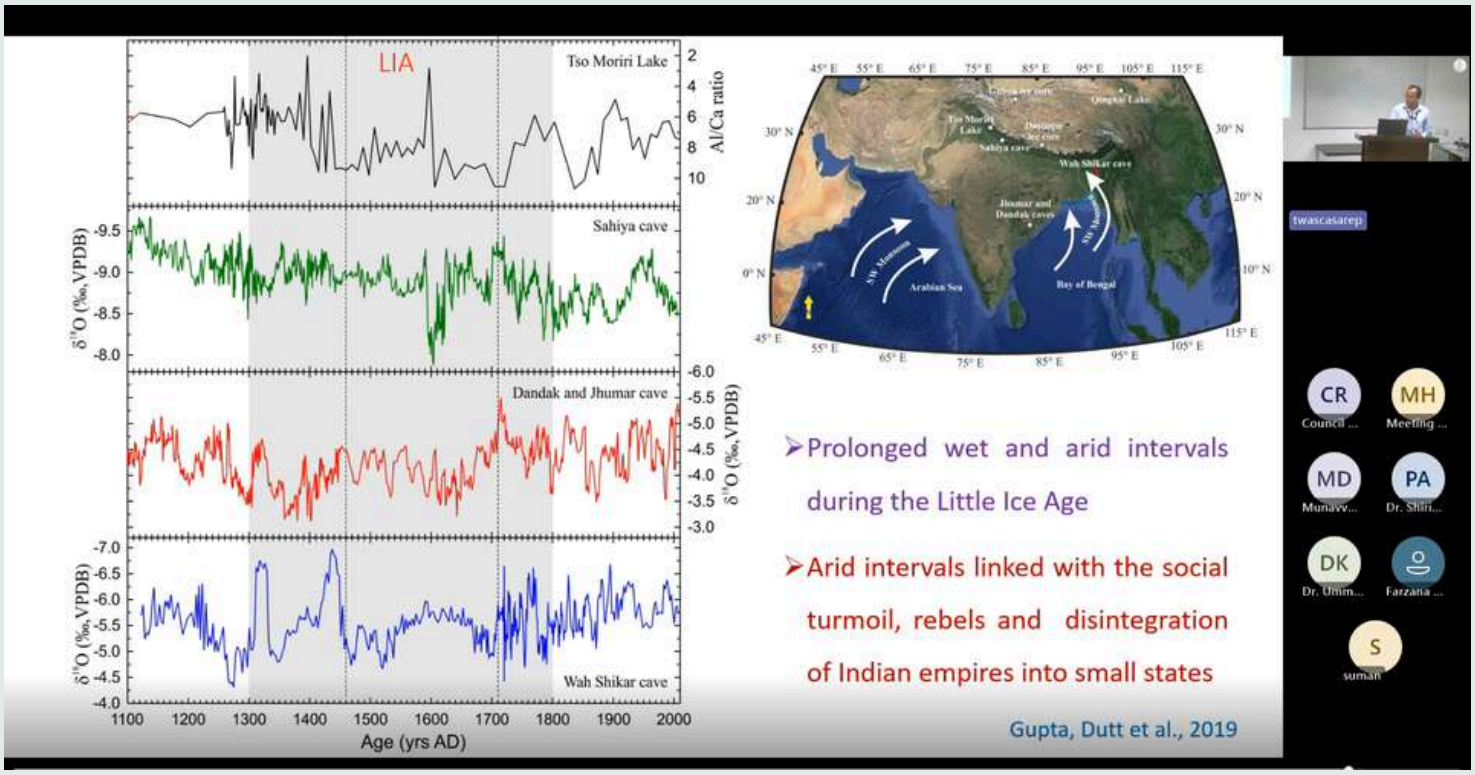




Ms. Rina Rani Palei, Indian Institute of Technology Kharagpur, India, presented her research work on "Ocean Circulation Dynamics in the Eastern Indian Ocean and Climate Variability in Northwest Australia over the Last 6.1 Million Years." Drawing on planktic foraminifera assemblages, isotopic records, and XRF data from ODP Site 763A, she reconstructed past oceanographic and climatic shifts in the region. Her results revealed major changes around 5.4–5 Ma, when a weakened Leeuwin Current (LC) and reduced mixed-layer thickness coincided with a drier NW Australia. Between 5.0 and 3.6 Ma, an intensified Indonesian Throughflow (ITF) strengthened the LC, creating a stratified water column and wetter conditions in NW Australia.

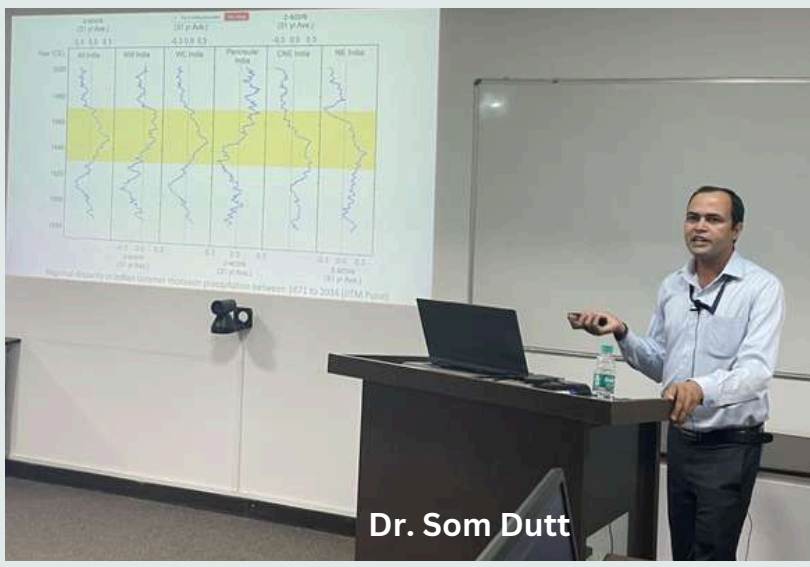
Ms. Palei explained that he closure of the Indonesian Seaway during the Middle Pliocene (3.6–3.2 Ma) restricted warm-water inflow, weakening the LC and intensifying regional aridity. She further highlighted significant transitions in the early Pleistocene (2.6–1.2 Ma) and during the Mid-Pleistocene Transition (1.2–0.6 Ma), when the West Australian Current exerted a strong influence. Her lecture provided valuable insights into how long-term ocean circulation dynamics have shaped regional climate variability.





Dr. Som Dutt, Wadia Institute of Himalayan Geology, India, spoke on "Unsteady Indian Monsoon and Evolving Climate Forcings during the Late Quaternary." He emphasised the critical role of the Indian Summer Monsoon (ISM), drawing on high-resolution speleothem oxygen isotope ($\delta^{18}O$) records from the Himalaya.

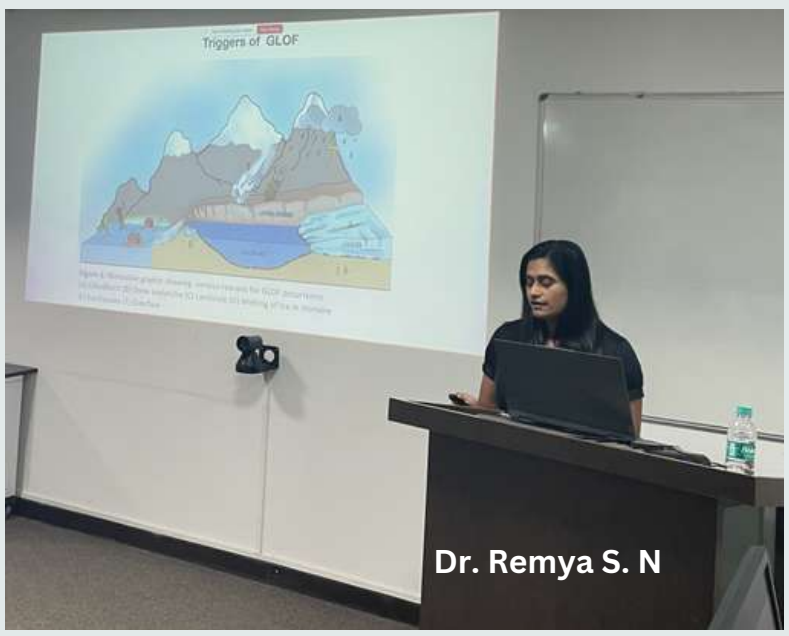
Dr. Dutt' study revealed enhanced monsoon precipitation during warmer phases such as 292–287 kyr BP, 46–27 kyr BP, the Bølling - Allerød, the Early Holocene, the Medieval Climate Anomaly, and the recent warming interval, typically aligned with odd marine isotope stages. Conversely, weaker ISM intensity characterised colder events, including the Last Glacial Maximum, the Younger Dryas, Heinrich events, and the Little Ice Age. Notably, abrupt declines in monsoon rainfall during these episodes underline the sensitivity of ISM to global climate perturbations.further explained how ISM variability has been shaped by multiple forcing's across temporal scales: solar insolation as a dominant driver, CO_2 climate coupling, and North Atlantic oscillations during colder phases, as well as shorter-term modulation by ENSO, Pacific Decadal Oscillation, and the Indian Ocean Dipole. Volcanic forcing also emerged as a key trigger for variability on annual to decadal scales.





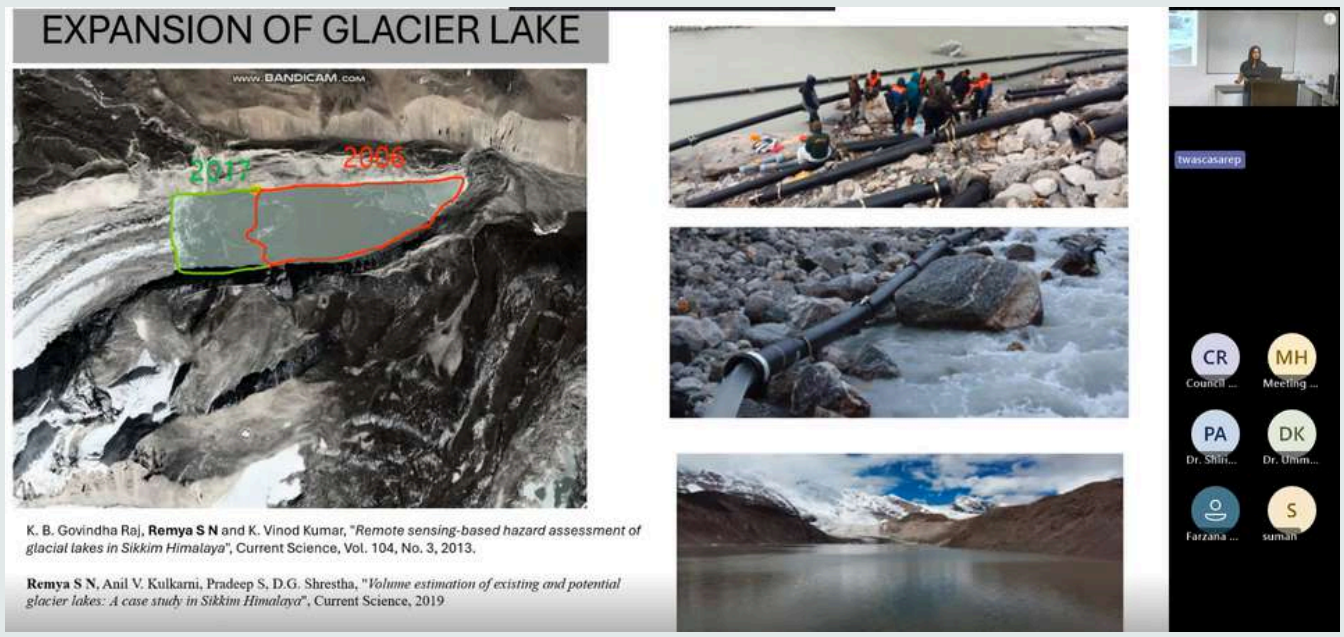


Dr. Remya S. N., Azim Premji University, India, concluded the scientific presentations with "Investigating the 2023 South Lhonak Lake Outburst in Sikkim: Dynamics, Triggers, and Impacts of a Himalayan GLOF Event." She traced the evolution of South Lhonak from a small supraglacial pond in 1962 to a moraine-dammed lake of 1.4 km^2 in 2023, documenting accelerated glacier retreat, moraine destabilisation, and calving events that culminated in the October 2023 GLOF.



Dr. Remya's study emphasised the urgent need for systematic monitoring and early warning systems to manage growing glacial hazards in the Himalaya.

Collectively, these presentations created a seamless narrative linking polar regions, high mountains, water resources, biodiversity, and paleoclimate, demonstrating how climate change reverberates across different Earth systems. The session highlighted not only the scientific depth of the research but also the critical role of young scientists in shaping future understanding and solutions.



The day concluded with reflections that tied together the themes of the meeting, aptly capturing its spirit as a "Celebration of Glaciers and Climate Science, Linking Past, Present, and Future."

Synthesis and Reflections from the Three-Day Young Scientists' Meeting

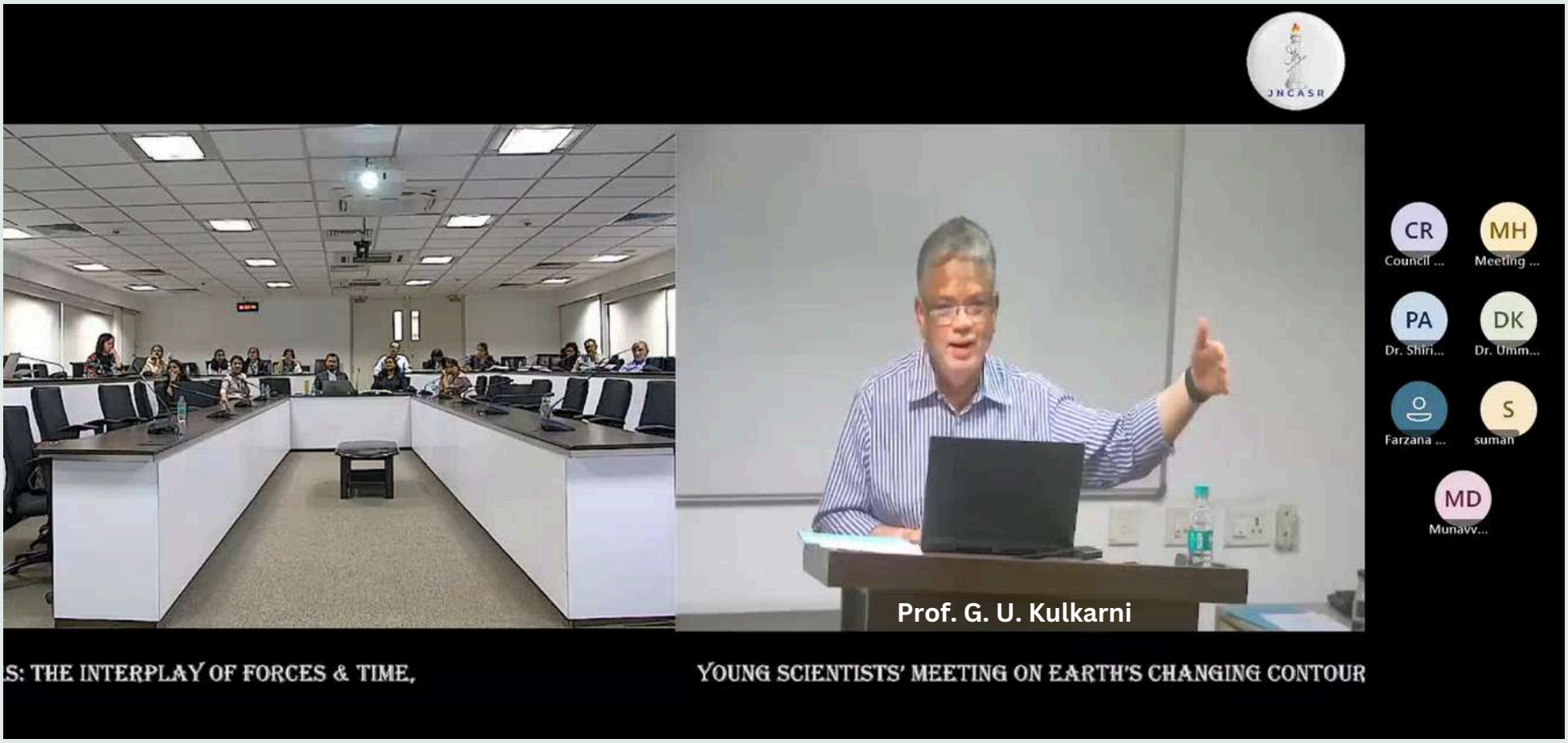
The Young Scientists' Meeting on "Earth's Changing Contours: The Interplay of Forces and Time" brought together a rich synthesis of ideas spanning tectonics, climate, natural hazards, and human resilience. Over three days, the gathering fostered a vibrant exchange between senior experts and early-career researchers, weaving together perspectives from the Himalaya, the polar regions, and beyond.

Day one established the foundation by highlighting the seismic and tectonic underpinnings of Earth's dynamic landscapes, underscoring the vulnerability of densely populated regions in South Asia to future megathrust earthquakes, tsunamis, and cascading hazards. Discussions also emphasised the importance of integrating geoscience insights with local adaptation strategies to strengthen community resilience.

The second day broadened the scope, connecting the cryosphere, seismic resilience, geomagnetism, and palaeogeographic reconstructions. These lectures demonstrated how Earth's past and present processes, from melting glaciers to magnetic field reversals and continental drift, remain deeply interconnected, offering valuable lessons for anticipating future risks.

The final day brought the dialogue full circle by linking polar research, Himalayan water resources, biodiversity, monsoon variability, and glacial hazards. The contributions of young scientists were particularly impactful, presenting innovative methods, updated datasets, and fresh insights into climate–cryosphere–biosphere linkages. Their research emphasised the urgency of monitoring and mitigating risks associated with glacial lake outburst floods, biodiversity loss, and climate extremes.

Taken together, the meeting underscored that addressing Earth's changing contours requires an integrative approach, combining tectonic, climatic, ecological, and societal dimensions, while fostering collaboration across borders and generations. By providing a platform for scientific exchange and mentorship, the event reaffirmed TWAS CASAREP's mission to empower young scientists, strengthen interdisciplinary networks, and advance knowledge for a more resilient and sustainable future.



Closing Remarks

The meeting concluded with closing reflections delivered by Prof. G. U. Kulkarni. Addressing Prof. V. Krishnan, Dr. Jaishri Sanwal Bhatt, the invited speakers, and all participants both in person and online, he emphasized that the Young Scientists' Meeting on "Earth's Changing Contours: The Interplay of Forces & Time" had served as a unique platform bridging disciplines that often remain isolated. Over the course of three days, he noted, the meeting had showcased an extraordinary spectrum of ideas, spanning geology, geophysics, climate science, civil and mechanical engineering, and theoretical physics. Together, participants navigated the vast scales of Earth system science from deep Earth processes and mantle–core interactions to surface dynamics, polar cryosphere, and even planetary magnetism beyond Earth. The discussions revealed how present-day climate change is transforming Himalayan glaciers, while also recalling evidence of ancient climatic extremes such as the Snowball Earth events. Young researchers were given a synoptic perspective on supercontinents and continental drift, tracing Earth's evolution across India, Tibet, Nepal, Hawai'i, and Europe. These insights reinforced how tectonic and climatic forces are intertwined, sculpting landscapes over millions of years. Equally compelling, he observed, were the lectures on earthquake resilience and infrastructure, which underscored the urgent need for sustainable and earthquake-resistant construction practices, drawing lessons from recent seismic disasters in the Himalaya, Makran Subduction Zone, and Türkiye. Such work, he added, highlighted the applied dimension of science in building safer, more resilient societies.

He further drew attention to the session on the poles in a changing world, reminding us that the Arctic and Antarctic are warming at rates two to four times the global average, with profound consequences for sea levels, weather extremes, food security, ecosystems, and methane release from thawing permafrost. Though remote, these regions are deeply connected to monsoons, ocean circulation, and climate variability that directly impact billions of people in the tropics.

Prof. Kulkarni also shared insights into his group's research on zero-energy building technologies, particularly adaptive window systems that can switch from transparent glass to opaque curtains without external power, demonstrating how low-cost, energy-efficient innovations can transform sustainability in everyday life. He stressed that interactions such as this meeting are vital, fostering networks of expertise that can shape the scientific and societal course of action for the decades ahead. Inviting participants to his laboratory, he welcomed them to witness ongoing research in sustainable building technologies and energy solutions at JNCASR.

In conclusion, Prof. Kulkarni expressed his hope that the meeting had sparked new curiosity, inspired interdisciplinary collaborations, and provided young researchers with a broader, integrated vision of Earth system science. He reminded all participants that understanding and adapting to Earth's changing contours is a shared, collective responsibility.

In continuation, **Prof. V. Krishnan** offered a passionate appeal to the next generation of scientists to recognise that: **"The future of our planet lies in your hands. How you choose to study, conserve, and innovate today will determine whether future generations inherit a thriving Earth or a diminished one."**



TWAS CASAREP extends its heartfelt gratitude to all invited speakers, young researchers, and participants, both in-person and online, for their insightful contributions and active engagement. Their dedication was instrumental in enriching the scientific discourse and ensuring the intellectual success of the meeting. We are deeply appreciative of the technical and logistical support that ensured the event's seamless execution. Our sincere thanks are due to Mr. Dileep Kumar for his expert technical assistance and to the office staff Mr. Amruth Gowda, Mr. Ajesh Sinha, and Mr. Raju for their invaluable support.

The successful organization of TWAS CASAREP activities would not have been possible without the foundational support of TWAS, Trieste, Italy. We reserve our deepest gratitude for this steadfast partnership. We are especially grateful for the encouragement and unwavering support of Prof. Umesh Waghmare, the President of JNCASR, the host institute of TWAS CASAREP.

The true strength of the meeting lay in its spirit of collaboration and cross-disciplinary knowledge-sharing, which will continue to inspire future research and scientific partnerships.



Together, the closing reflections encapsulated the spirit of the meeting: collaborative, interdisciplinary, globally aware, and deeply committed to solutions for a rapidly changing planet.

Report prepared by

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Glimpse from the Meeting







Abstracts of Invited Lectures

1 Seismotectonics of the Himalaya and the Current Understanding of Possible Earthquake Hazards in the Region

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Abstract

Nearly five decades of continuous high-quality seismic and GNSS monitoring, along with deep seismic profiling in Nepal and south Tibet, have greatly advanced our understanding of Himalayan seismotectonics. These efforts have clarified the geometry of the Main Himalayan Thrust (MHT), the master fault controlling active tectonics, and the mechanisms of plate coupling and decoupling along it. Mapping active faults, trenching across numerous sites along the Main Frontal Thrust (MFT), and analyzing historical earthquake records in India and Nepal have identified stress accumulation zones and seismic gaps with the potential to generate future great earthquakes. Paleoseismic trenching has revealed large past earthquakes absent from historical accounts and has allowed magnitude estimation for pre-instrumental events.

Current research identifies two major seismic gaps in Nepal and adjacent region capable of producing earthquakes exceeding Mw 8. The Western Nepal Seismic Gap (extending areas from Nepal border to Dehradun in India), west of the 2015 Gorkha earthquake rupture, last broke in 1505 AD, and has been accumulating strain for over five centuries. The Eastern Nepal–Darjeeling–Sikkim Seismic Gap, stretching east of the Kosi River into India, has been quiescent for at least ~800 years in eastern Nepal and up to ~1,300 years in Sikkim. Both are expected to produce Mw 8.0–8.5 earthquakes, lying entirely outside the 2015 and 1934 rupture zones. The consequences of such events would be devastating. In eastern Nepal, including the Kathmandu Valley, 15–20 million people are at risk, many in densely built, earthquake-vulnerable environments. In western Nepal, nearly the entire remaining national population (~15 million) faces similar danger, compounded by rugged terrain, fragile slopes, and limited transport links. Any large seismic event in the Himalaya is bound to have a similar devasting effects in the adjacent plains in India.

During the interseismic period, out of the nearly 40 mm of convergence between the Indian and Eurasian plates, the MHT beneath the Himalaya accommodates about 18–20 mm/year convergence. Seismic tomography, microseismicity studies, and geodetic models have refined our understanding of its structure and coupling variability. GNSS and InSAR data show that both the western and eastern seismic gap regions are strongly locked, storing elastic strain. Paleoseismology along the MFT has confirmed its capability to produce multi-segment ruptures several hundred kilometers long. These can generate Himalayan-scale earthquakes exceeding Mw 8, validating the scale of hazard in both seismic gaps.

The 2015 Gorkha earthquake ruptured only part of the locked MHT beneath central Nepal, stopping short of the surface. This demonstrated that Himalayan megathrust events may sometimes break only a portion of the seismogenic zone, leaving remaining sections primed for future rupture. Geodetic and seismological studies reveal strong along-strike variability in MHT coupling. While some areas are fully locked to depths of 15–20 km, others show partial decoupling possibly due to variations in rock composition, fluid pressures, or thermal conditions. Such heterogeneity likely controls earthquake segmentation and the persistence of seismic gaps. It also poses challenge to earth scientists for a more reliable interpretations for earthquake hazards in any region.

Integrated geological, geodetic, and seismological research has transformed our understanding of Himalayan seismotectonics. Yet, the presence of large, long-locked seismic gaps in both western and eastern Nepal and adjoining Indian sections underscores the urgent need for sustained monitoring and preparedness. The likelihood of future Mw 8+ earthquakes is high, and their impacts on millions in Nepal and adjacent India could be catastrophic. Strengthening earthquake-resilient infrastructure and maintaining updated hazard assessments and preparedness are essential steps toward reducing this inevitable risk.

2

Seismicity, Seismotectonics, and Seismic Hazard Assessment of the Himalaya and Makran Subduction Zone, Pakistan

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Introduction

The Himalayan and Makran Subduction Zone regions in Pakistan are among the most seismically active areas globally, shaped by complex tectonic interactions. The Himalayas are a product of the ongoing collision between the Indian and Eurasian plates, resulting in intense crustal deformation, thrust faulting, and frequent large-magnitude earthquakes. The Makran Subduction Zone, on the other hand, is characterized by the northward subduction of the Arabian Plate beneath the Eurasian Plate, exhibiting both megathrust seismicity and slow-slip events. This study explores seismicity, seismotectonics, and seismic hazard assessment of these regions, incorporating Peak Ground Acceleration (PGA) values and referencing key studies.

Seismicity and Seismotectonics of the Himalaya

Tectonic Setting

The Himalaya are formed by the ongoing collision of the Indian Plate with the Eurasian Plate, which began approximately 50 million years ago. This collision has resulted in the uplift of the Himalayan mountain range and the formation of major thrust faults, including the Main Himalayan Thrust (MHT), a primary décollement accommodating convergence. The MHT extends over 2,400 km and dips gently northward, acting as a major source of seismic activity.

Seismic Activity

The Himalaya are characterized by shallow crustal earthquakes, often exceeding magnitudes of Mw 7.0. Historical events, such as the 2005 Kashmir earthquake (Mw 7.6), underscore the region's seismic vulnerability. The MHT's geometry and slip rates vary along its length, influencing earthquake recurrence intervals and magnitudes. Recent GPS studies indicate convergence rates of ~18–20 mm/year in the western Himalayas, contributing to significant strain accumulation.

Seismotectonic Features

The region is marked by several active faults, including the Main Boundary Thrust (MBT) and Main Central Thrust (MCT), which accommodate deformation. The MHT is locked in certain segments, leading to strain accumulation and eventual release in the form of large earthquakes. The 2005 Kashmir earthquake, for instance, occurred on a blind thrust fault associated with the MHT, causing widespread devastation.

Seismicity and Seismotectonics of the Makran Subduction Zone

Tectonic Setting

The Makran Subduction Zone is formed by the northward subduction of the Arabian Plate beneath the Eurasian Plate. It spans approximately 900 km along the coast of Pakistan and Iran and is characterized by low-angle subduction. The Makran region is unique due to its combination of megathrust seismicity and slow-slip events.

Seismic Activity

The Makran Subduction Zone exhibits lower seismicity rates compared to the Himalayas but poses a unique hazard due to its potential for large tsunamigenic earthquakes. The 1945 Mw 8.1 earthquake and subsequent tsunami highlight the region's risk. The Makran's subduction dynamics are complex, with evidence of both locked and creeping segments. Slow-slip events and low-angle subduction contribute to its seismic behavior. Offshore seismic activity increases the tsunami hazard, particularly for coastal cities like Karachi.

Seismotectonic Features

The Makran Subduction Zone is divided into eastern and western segments, with the eastern segment being more seismically active. The 1945 earthquake occurred in the eastern segment, generating a tsunami with wave heights of up to 15 meters. The region's offshore activity and shallow dip angle increase the potential for tsunamis, making it a significant hazard for coastal populations.

Seismic Hazard Assessment Methodology

Seismic hazard assessment in these regions employs probabilistic and deterministic approaches, integrating fault geometry, historical seismicity, and ground motion prediction models. Probabilistic Seismic Hazard Analysis (PSHA) is widely used to estimate PGA values for different return periods, while deterministic methods focus on worst-case scenarios.

Himalaya.

The Himalaya exhibit high seismic hazard due to shallow crustal earthquakes. PGA values in the region range from 0.2g to 0.6g for a 475-year return period, with higher values near active faults like the MHT. Urban centers such as Islamabad and Muzaffarabad are particularly vulnerable, with estimated PGA values exceeding 0.4g. The 2005 Kashmir earthquake, for instance, recorded PGA values of up to 0.6g, causing widespread destruction.

Makran Subduction Zone

The Makran's seismic hazard is influenced by its subduction dynamics and offshore activity. PGA values for a 475-year return period range from 0.1g to 0.3g, with higher values near the coast. Tsunami hazard assessments indicate wave heights of up to 15 meters for worst-case scenarios, posing a significant threat to coastal populations. The 1945 earthquake, for example, generated PGA values of 0.2g and a tsunami with wave heights of 12–15 meters.

Conclusion

The Himalaya and Makran Subduction Zone represent two distinct yet equally hazardous seismic environments in Pakistan. The Himalayas face high hazard due to shallow crustal earthquakes, while the Makran's risk is compounded by its subduction dynamics and tsunami potential. Urban centers like Islamabad and Karachi require stringent building codes and preparedness measures to mitigate seismic risks. Improved monitoring and risk assessment strategies are essential for enhancing resilience in these tectonically active regions.

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3

Himalayan contours: interplay of tectonics and climate

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Abstract

The Himalaya not only serves as the world's best example of the active continental collision process, but it also serves as an iconic site of where tectonics influences climate and climate influences the morphology of the mountain belt. The collision between the Asian and Indian continents initiated between 50 and 60 million years ago and has resulted in large faults that have moved slices of the earth's crust southward resulting in a belt of high topography. The traces of these faults run parallel to the mountain belt and are visible today, with some of them still active. The high topography blocks the Indian monsoonal rains from moving northward into Tibet such that Tibet stays arid and the Himalayan mountain front receives strong seasonal rain during the summer months. At the highest elevations the precipitation has fallen as snow which has produced extensive glaciers. The erosional forces from the mountain glaciers act to deepen the valleys thus enhancing topographic relief.

More recent faulting has broken and weakened rock thus also enhancing erosion and leaving valley walls susceptible to landslides. Landslides dam rivers, ultimately leading to flooding events when the dams break. Flooding further causes valley erosion. As temperatures warm with climate change, the high mountain glaciers melt at faster rates. Typically that melt water ponds on top of the glaciers or at the toe of the glaciers. If those ponds are released flooding occurs and the cycle of erosion, landsliding, and flooding is hastened. In recent years, Himalayan valleys have seen more frequent flooding events which take a heavy toll on villages, farm activity, hydroelectric facilities, etc. There is ongoing work to understand all of the aspects of interplay between tectonics, climate, and the shaping of the mountain landscape.

28.08.2025

4

The Changing Cryosphere

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Abstract

Our Earth has been constantly changing from the time it was created till now. It will continue to change until it is destroyed. This talk will focus on the changes of one of its components, the Cryosphere, namely the ice on earth. We will first give a brief answer to the question "Where on earth is the ice now?" We will then address the question, "Where on earth was it earlier and how do we know that?" Finally, we will discuss the question "Where on earth will it be in the near future?" and the consequences of the changes for sea level rise and river flow.

28.08.2025

A Review on the Recent Large Earthquakes, Numerical Simulations and Urban Seismic Resilience in Türkiye

5

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Abstract

Türkiye is located in a tectonically very active region and experiences multiple large events every couple of years. The key step in seismic risk mitigation urban regions in Türkiye and elsewhere in the world is accurate estimation of the risks. Risk modeling involves input from multiple fields including geophysical and earthquake engineers, physical and economic planners as well as insurance companies. Risk mitigation efforts include seismic hazard assessment, geotechnical investigations, building fragility models, physical and social loss functions. Strong motion records of earthquakes are the key components of these efforts. Nowadays, in addition to the records from past events, the simulated ground motions have the potential to become a prominent thread of earthquake engineering practice due to ever-increasing computational capabilities and advances taking place in earthquake source modeling and site characterization techniques. The use of simulated motions could help explore seismic resilience of urban regions and distributed infrastructure while taking into account complex source and site effects.

Additionally, simulated ground motions also have the potential to provide site-specific ground motion datasets for engineers while covering a wide range of parameters including event magnitude and source-to-site distance. In this study, we present a review of the past and ongoing research on the last large earthquakes, use of simulated ground motions for seismic damage and loss modeling in Türkiye. Both past events and scenario earthquakes are modeled. The study areas of these applications are the urban regions on North Anatolian and East Anatolian fault zones as well as the Aegean Sea region in Türkiye.

Earth's Dynamic Magnetic Field and its Origin

6

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Abstract

The Earth’s magnetic field acts as a shield against high-energy particles from the Sun and outer space, thereby protecting our atmosphere and the life that it supports. The Earth’s field has varied considerably over geological time, sometimes being weak, sometimes strong and intermittently reversing direction completely, so that North becomes South and South becomes North. This pattern of changes, and notably the polarity flips, have left a distinctive fingerprint on the surface of the Earth. Data from volcanic rocks and sediments show that the last flip in magnetic field polarity occurred about 780,000 years ago. The Earth’s magnetic field is powered by a convection-driven dynamo operating in its electrically conducting liquid core. The theory of the geodynamo made significant progress in the last century due to advances in the subject of magnetohydrodynamics (MHD), which deals with the flow of electrically conducting fluids in magnetic fields. In this talk, I shall review the significant developments that shaped our present understanding of the Earth's dynamic field.

7

The Early Permian breakup of Pangea (Himalayan belt) and Early Jurassic (?) drift of the Lhasa Block from the Peri-Godwanan margin – palaeogeographical reconstructions from SE Asia perspective

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Abstract

In the NW Indian Himalaya, the Panjal Traps span around 10,000 km^2, predominantly distributed across the Kashmir Valley, Pir Panjal, and Zanskar ranges. Volcanic sequences around the Kashmir Valley reach up to ~3000 m in thickness, while eastern exposures are comparatively thinner (~300 m) (Stojanovic et al., 2016; Shellnutt et al., 2021). A prominent and continuous volcanosedimentary section occurs at Guryul Ravine (Srinagar vicinity), recording a marine transition between Permian and Triassic units. These uppermost Panjal Traps comprise basaltic pillow lavas interspersed with peperites, manifesting as whitish limestones marked by numerous small, sharply bounded basaltic fragments. The overlying strata include siliceous novaculites, succeeded by Middle Permian units. Radiometric analyses date the Panjal Traps to the Early Permian (ca. 289 Ma) (Shellnutt, 2016).

Peperites represent a distinctive type of volcanosedimentary association, characterized by sharply bounded volcanic fragments (commonly basaltic) interspersed with sedimentary deposits. These peculiar rock types result from submarine basaltic eruptions on the seafloor, intruding into unconsolidated, water-saturated carbonate mud, thereby forming a contemporary assemblage with the surrounding sediments. Typically, peperites coexist with other volcanosedimentary rock types, including basaltic pillow lavas, pyroclastic debris flows, and volcanoclastic or pyroclastic turbidites, which serve as crucial chronological markers for volcanic events when associated limestones are dated using fossils. On the other hand, in the Zanskar Himalaya, notably around Rangdum and Padum, the Panjal Traps feature basaltic pillow lavas (at Rangdum) and pāhoehoe lava horizons (at Padum), highlighting a volcanogenic episode associated with rifting and the impending separation of a >13,000 km-long string of lenticular-shaped, ribbon-like Cimmerian Continent concurrent with the Neotethys Ocean opening by seafloor spreading (Chen & Xu, 2021). Correlating these Early Permian volcanogenic phenomena with other Himalayan occurrences (e.g., Phe, Nar-Tsum, Bhote Kosi, Manaslu, Arbor, Selong) is vital for deciphering the geodynamic evolution along the peri-Gondwanan southern Tethyan margin and the first step of Pangea's breakup.

The huge, up to 40–50 cm long bivalves, Lithiotis, Cochlearites, and Lithioperna, which dominated within "Lithiotis" facies (sensu – Fraser et al., 2004 with literature cited therein), are the most significant representatives of buildup-makers of shallow marine/lagoonal bivalve mounds (reefs) in numerous places of Tethyan-Panthalassa margins during Pliensbachian-Early Toarcian times. The distribution of Lithiotis-facies bivalves from Western (Spain, Italy) and Middle Europe (Slovenia, Croatia, Albania) through north Africa (Morocco) and the Arabian Peninsula (Oman, Arabian Emirates) up to Timor Island, Himalaya Mts (Nepal, China), and the western margin of both Americas (USA, Peru) indicates a worldwide, rapid expansion of such Lithiotis-type bivalves (Leinfelder et al., 2002; Fraser et al., 2004; Krobicki & Golonka, 2009). TThe Early Jurassic migration routes were connected both with the breakup of Pangea and oceanic circulation, which facilitated the high speed of distribution of larvae of such oyster-like bivalves. Previously - in Triassic - the migration of sea fauna (Late Triassic crinoids, mollusks, crustaceans, and so on) was going through the vast eastern Tethys branch of the Panthalassa Ocean, which is perfectly visible in the distribution of the typical "Alpine" fauna of the western Tethys found in the numerous terranes along the western coasts of South and North America. The fauna did not have a possibility to migrate westward, but it could use the numerous terranes within Panthalassa as "stepping-stones," allowing relatively free migration eastward from the Alpine Tethys (Kristan-Tollmann & Tollmann, 1985). The supercontinent Pangea was formed during the Carboniferous time as a result of the Hercynian orogeny. The separation of Laurusia and Gondwana, which was initiated by the Triassic breakup of Pangaea, continued during Early-Middle Jurassic time. The Early Triassic continental rifting was magnified at the Triassic/Jurassic boundary, and the Atlantic Ocean originated as a consequence of this breakup.

In effect, the origin of the narrow sea strait, so-called "Hispanic Corridor," took place between these two continents, and the connection between the Panthalassa Ocean (Proto-Pacific) and the western (Alpine) Tethys gradually started in Early Jurassic, most probably in Sinemurian-Pliensbachian times. Therefore, the widespread distribution of numerous fossil invertebrate groups took place during these times (Hallam, 1983; Damborenea, 2000; Arias, 2006; see also – Damborenea & Manceñido, 1979; Boomer & Ballent, 1996; Arias, 2007, 2008; Venturi et al., 2006; Krobicki & Golonka, 2007). The recovery of marine fauna after such a dramatic biological event was mainly marked by the distribution of Lithiotis-type bivalve buildups (e.g., Leinfelder et al., 2002; Fraser et al., 2004; Krobicki & Golonka, 2009). Their worldwide distribution indicates both the very rapid occupation of specific ecological niches (mainly shallow-marine/lagoon-type carbonate sedimentation) and the paleogeographic/geodynamic regimes during the breakup of Pangea in Pliensbachian-Early Toarcian times (Krobicki & Golonka, 2007).

The key to understanding the migration pattern of these buildups is connected with geodynamic reconstruction, mainly including Asian paleogeography. The occurrence of Lithiotis buildups from westernmost Asia/Arabia (eastern Turkey, Iran, Iraq, Kuwait, Oman) to central Asia (India, Nepal, China – Tibet) during this time suggests a migration path from west to east—from the western Tethys through the Panthalassa Ocean up to the western margins of North and South America (USA, Peru). Especially, such buildups in Tibet are important (Jadoul et al., 1998; Yin et al., 1998, 1999; Yin & Enay, 2004; Shi et al., 2006), because they occupied the midway point of such a path and were connected with the migration of several terranes during Early-Middle Jurassic times (e.g., Lhasa block) (Golonka et al., 2006).

Simultaneously, the collision of the Chinese and Cimmerian plates was concluded and led to the final assembly of the Asian part of Pangea (Golonka & Ford, 2000; Golonka, 2007). All major continents and major plates were sutured together, with the exception of some Tethyan terranes and terranes west and northwest of North America and in Panthalassa. The closure of Paleotethys was in its last stage.

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Exploring Poles in a Changing World – New Frontiers and Indian Endeavours

8

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Abstract

Global warming affects different parts of the world differently. The Arctic and Antarctic have experienced dramatic warming two to four times higher than the rest of the world in recent decades, due to a process known as polar amplification. Polar warming is affecting the entire planet through its impact on sea level, extreme weather events, food security, ecology and environment, and the defrosting of the permafrost is leading to increased methane emission and increasing natural hazards. The Indian Antarctic exploration is more than four decades old and have matured over the time with two winter-over stations, enabling us to expand the activities across the continent and host many international field campaigns based at our Antarctic stations. India initiated its Arctic endeavours in 2007, supported by a research station in Svalbard. We are also expanding our scientific activities across the region such as Canadian High Arctic, Greenland and Arctic Ocean. One of the major focus of Indian studies in the polar regions is the role and response of cryosphere and biosphere in a changing climate. Although the Antarctic and Arctic appear so remote for tropical countries like India, studies have shown that polar-tropical teleconnections influence global climate patterns, weather systems, and ocean circulation on a hierarchy of time scales. In a rapidly changing world, the two-way linkages between the poles and tropics can play key roles in the dramatic evolution of these sensitive regions and offers a new frontier research opportunity

Profile of the Invited Speakers



Prof. Bishal Nath Upreti

Nepal Academy of Science & Technology,
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Prof. Bishal Nath Upreti is a distinguished Nepali geologist with Master's and PhD degrees in geology from India. He is a Fellow of the Nepal Academy of Science and Technology (NAST), The World Academy of Sciences (UNESCO-TWAS), and the Zambia Academy of Sciences.

He served as Head of the Department of Geology and Dean of the Institute of Science and Technology at Tribhuvan University, and held professorships at the University of Zambia and Arba Minch University, Ethiopia. He has also been a visiting professor at leading institutions including Paris University, Erlangen-Nürnberg University, Jawaharlal Nehru Centre for Advanced Scientific Research, University of Hiroshima, and others.

With over 50 years of research on the Nepal Himalaya, he has authored and edited several books and published more than 100 papers. His honors include the C.N.R. Rao Prize (TWAS), Honorary Fellowship of the Geological Society of America, Toni Hagen Memorial Award from Nepal Geological Society and Nepal's Suprabal Gorkha Dakshin Bahu.



Prof. Mona Lisa

Department of Earth Sciences, Quaid-i-Azam
University, Islamabad, Pakistan

Prof. Mona Lisa is a distinguished geophysicist and Professor at the Department of Earth Sciences, Quaid-i-Azam University (QAU), Islamabad. She is Pakistan's first Ph.D. in Earthquake Seismology, and her doctoral research laid the foundation for the nation's first comprehensive building code (2007, Pakistan Engineering Council). Her contributions were highlighted by Nature in 2006 in a feature titled "Portrait of the Seismologist as a Young Woman". She was ranked among the top geoscientists in Pakistan in 2007 and awarded the Gold Medal of the Pakistan Academy of Sciences in 2009.

Her expertise in focal mechanism analysis, vital for understanding fault orientation and seismic sources, is unique in Pakistan and widely sought after by both scientific and institutional bodies. She has received prestigious fellowships including the DAAD Fellowship at GFZ Potsdam, and is a regular associate of ICTP, Trieste, with memberships in the Pakistan Academy of Sciences, IRIS, and MESF. She has also served on expert panels such as the Pakistan Engineering Council's Building Code Subcommittee and the Board of Experts at the Centre for Earthquake Seismology, Islamabad. Prof. Mona Lisa's pioneering work continues to advance seismic research, hazard assessment, and mentorship, inspiring the next generation of geoscientists in Pakistan.



Prof. Mary S. Hubbard

Professor Emerita, Montana State University
Bozeman, Montana, United States

Prof. Mary Hubbard is a recently retired professor of Earth Sciences at Montana State University (MSU). She has studied mountain belt formation around the world, with a particular focus on the tectonics of the Himalayas. She served as a Fulbright Specialist in Nepal in 2017 and a Fulbright Scholar in Nepal in 2022.

Prof Mary has previously held faculty positions at Utah State University, the University of Maine, and Kansas State University, and has served as Department Head at MSU and at Kansas State. At Utah State University, she served as Dean of the College of Science and as the Vice Provost for Global Engagement. Mary is an active Rotarian in the Bozeman Sunrise Rotary Club and leads annual visits to support community-based projects in Nepal.



Prof. Shankar R.

Institute of Mathematical Sciences, Chennai

Prof. Ramachandran Shankar is a distinguished physicist whose career reflects both intellectual breadth and remarkable adaptability. He began his academic journey in high-energy physics, later moving into condensed matter physics, where he explored how concepts from topology illuminate the behavior of strongly interacting electronic systems. He joined the Institute of Mathematical Sciences (IMSc), Chennai in 1991, where he contributed significantly as a researcher, mentor, and communicator of science.

The 2004 Indian Ocean tsunami, which struck close to home in Chennai, deeply influenced him, steering his scientific curiosity toward earth sciences. In collaboration with oceanographers at the National Institute of Oceanography, Goa, he undertook important research on tsunami dynamics. Soon after, he brought together his lifelong passion for physics and the Himalaya by turning his attention to glaciology and climate change. Since 2008, he has been engaged in research aimed at deepening our understanding of Himalayan glaciers and their response to a warming climate.



Prof. Ayşegül Askan

Earthquake engineering - Engineering seismology, Middle East Technical University Ankara / Türkiye.

Prof. Ayşegül Askan is a professor of civil engineering, earthquake studies and applied mathematics at Middle East Technical University (METU) in Ankara, Turkey. She received her PhD from Carnegie Mellon University in 2006 with her thesis focusing on full waveform inversion for seismic velocity structures. Prof. Askan's field of expertise includes engineering seismology, earthquake engineering, scientific computing and numerical methods, effects of simulated ground motions on structures, multi-scale seismic risk and loss estimations in urban regions, structural reliability and parameter estimation problems for site characterization. She holds several administrative positions in education and research. She is the department head of Earthquake Studies program at METU. She is the current general secretary of Earthquake Engineering Association of Turkey and a member of the National Disaster and Emergency Consultancy Board of Turkey. She is a board member of COSMOS and the current Vice-Director of European Seismological Commission. Prof. Askan has led and participated in several EU projects, Turkish-Japanese bilateral projects and national projects focusing on seismic hazard and risk problems. She joined Seismological Research Letters as an Associate Editor in 2024. She has supervised more than 35 graduate students at METU since 2007. The list of publications by Prof. Askan includes 72 peer-reviewed international journal articles and 6 book chapters with an h-index of 27.



Prof. Binod Sreenivasan

Centre for Earth Sciences, Indian Institute of Science, Bangalore, India

Prof. Binod Sreenivasan is presently Professor and Chair of the Centre for Earth Sciences at the Indian Institute of Science (IISc), Bangalore, India. Prof. Sreenivasan earned his B Tech (Honours) in Mechanical Engineering from the National Institute of Technology, Calicut, and MS from the Indian Institute of Technology, Madras. After a stint as a Scientist at the Indian Space Research Organization (ISRO), he obtained his PhD from the University of Cambridge, specializing in fluid mechanics. Following this, he held postdoctoral fellowships in France and the UK, which included a Leverhulme Research Fellowship at the University of Leeds. Back in India, he served on the faculty at the Indian Institute of Technology (IIT) Kanpur for nearly 3 years before moving to the Indian Institute of Science (IISc), Bangalore, where he has been at the Centre for Earth Sciences since 2012.

Prof. Sreenivasan's research interests are in the areas of planetary magnetism, dynamo theory, and vortex dynamics.



Prof Michał Krobicki

Faculty of Geology, Geophysics and Environmental Protection, AGH University of Krakow, Poland

Prof. Michał Krobicki is a distinguished geologist at the Faculty of Geology, Geophysics, and Environmental Protection, AGH University of Kraków, Poland, specializing in paleogeography, plate tectonics, and geotourism. His academic career has included impactful roles such as Director of the Upper Silesian Branch of the Polish Geological Institute (2011–2014) and Assistant Professor at the Carpathian Branch in Kraków (2015–2017). Prof. Krobicki has published over 150 scientific papers focused on stratigraphy, paleontology, paleoceanography, paleoclimatology, and the regional geology of the Alpine-Carpathian-Himalayan realms.

He has also led international initiatives, notably serving as leader of UNESCO's IGCP 710 Project ("Western Tethys meets Eastern Tethys") from 2020 - 2024, serves as an Editor-in-Chief of Geotourism/Geoturystyka, and coordinates regional cooperation with Southeast Asian universities, including institutions in Nepal.

Prof. Krobicki has been a strong advocate for public engagement with Earth sciences, emphasizing the importance of geological heritage in cultural identity and sustainable development. His international collaborations, particularly in the Carpathian region and with UNESCO–IUGS initiatives, have strengthened global understanding of stratigraphy, paleoenvironments, and geodiversity.



Prof. Thamban Meloth

National Centre for Polar and Ocean Research (NCPOR), Goa, India

Prof. Thamban Meloth is a distinguished polar scientist, currently the Director of the National Centre for Polar and Ocean Research (NCPOR) in Goa, India, under the Ministry of Earth Sciences. Prof. Meloth has undertaken numerous scientific expeditions to Antarctica, the Arctic, the Himalayas, and the Southern Ocean, including being a member of India's inaugural scientific expedition to the South Pole in 2010.

He was instrumental in establishing India's first ice-core laboratory at NCPOR, enhancing the nation's capabilities in polar research. His contributions have been widely recognized: he received the National Geoscience Award in 2013 and has been elected Fellow of the Indian Academy of Sciences (2024), the National Academy of Sciences India (2020), and the Norwegian Academy of Polar Research.

Prof. Meloth also represents India in leading international polar science bodies, including the Scientific Steering Group of the WCRP's Cryosphere and Climate (CliC) project, WMO's Panel on High Mountain Observations (PHORS), and serves on key councils such as SCAR and IASC. His work continues to shape the field of polar research and inspire emerging scientists regionally and globally.

Abstracts from Young Scientists'

Geospatial Technologies for River Flow Modeling and Water Resource Management under Climate Change: A Case Study of the Lake Balkhash Basin

9

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Abstract

By the mid-21st century, the rapid advancement of geospatial technologies has opened new methodological horizons for the study, management, and modeling of water resources. In hydrology and water resource management, cartography, Geographic Information Systems (GIS), and Remote Sensing (RS) play a crucial role in enabling spatial analysis, modeling of water body dynamics, and comprehensive assessment of climatic and anthropogenic impacts.

This study focuses on the Lake Balkhash basin, one of Central Asia's most ecologically and economically significant transboundary water systems. The research analyzes the seasonal variability of river flow in the basin and its response to climatic changes and human activities. Utilizing RS datasets (MODIS, Sentinel, Landsat), GIS-based spatial modeling, and the HBV hydrological model, the study investigates snow cover distribution, land cover changes, evapotranspiration, and infiltration. The integration of RS data and hydrological models enables precise streamflow prediction and assessment of extreme hydrological events under SSP2-4.5 and SSP5-8.5 climate scenarios.

Machine learning algorithms were employed to develop a rapid detection system for droughts and floods, improving decision-making for water security and disaster response. The study also highlights the added complexity of managing transboundary water resources, underscoring the necessity of international cooperation, particularly between Kazakhstan and China.

The research outcomes include the development of 44 thematic maps, hydrological simulations, and predictive models that serve as essential tools for sustainable water resource planning, climate adaptation strategies, and ecological stability. The integration of geospatial methods, hydrological modeling, and machine learning provides a robust scientific foundation for addressing water scarcity and enhancing regional water governance.

10

Genomic Characteristics of Novel Thermobaculum Spp., from a High-Altitude Geothermal Spring in Tajikistan

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Abstract

Geothermal springs, unique ecological niches, are formed through the release of warm geothermal groundwater from the Earth's crust. These thermal environments are vibrant sources of unique microorganisms, novel enzymes, and ongoing research into the origins and diversity of microbial life. Thermophilic bacteria, thriving at elevated temperatures (typically between 45°C and 80°C, and in some cases over 100°C), are well-adapted to the extreme conditions of geothermal springs, characterized by high temperatures, varying pH levels, and mineral-rich waters. These conditions foster microbial communities with remarkable survival adaptations. In Tajikistan, thermophilic bacteria not only contribute to ecological research but also hold industrial potential in biotechnology, bioenergy production, and environmental management.

The aim of this study is to analyze the geothermal characteristics of high-altitude geothermal springs in Tajikistan through microbial analysis. By conducting this analysis, the researchers aimed to identify several characteristics that have contributed to the development of geothermal use and enzymatic processes in the study area. Studying the microbial characteristics can provide a deeper understanding of the geothermal system and its suitability for various applications.
A novel thermophilic bacterium from the phylum Chloroflexi was isolated from geothermal springs in the Tamdykul and Khodja-Obi-Garm regions of Tajikistan, with temperatures and pH values of 88°C, pH 7.4 and 93°C, pH 8.5, respectively. The locations are at coordinates 39°25′10.20″N, 71°13′13.0″E and 38°53′41.45″N, 68°47′15.64″E, at elevations of 2,198 m and 1,835 m, and with conductivities of 1,019 and 4,378.3 µS/cm.

The isolate was an obligately aerobic, non-spore-forming rod, which formed pink colonies on R2A agar plates. The isolates, designated strains T2pink, T4pink, and KhOGp, grew in the temperature range from 55 - 80°C, and at pH values ranging from 5 to 10. Based on the 16S rRNA gene sequence, it was identified as a member of the Thermobaculum genus, sharing 94.2% sequence identity with the only described species in this genus, Thermobaculum terrenum, which was recovered from a hot spring in Yellowstone National Park, USA. Draft genome sequencing yielded 3,045,080 bp, 3,062,676 bp, and 5,792,759 bp of unique sequence data distributed into 47, 21, and 44 contigs with an average GC content of 51.6%, 51.67%, and 62.82%, and with a genome completeness of 97.6% and 98.58%. Average nucleotide identity (ANI) and digital DNA-DNA hybridization (dDDH) values for strains T2pink, T4pink, and KhOGp were (89.5% and 36.5%), (89.6% and 36.6%), and (89.9% and 37.1%) respectively, demonstrating that these strains constitute a separate and distinct genome species, and the first reported thermophile from Tajikistan. It actively degraded cellulose, casein, starch, and amylase, and yielded positive results for a large number of hydrolytic enzymes e.g., C8 esterase lipase, lipase (C), amino acid arylamidases, β-galactosidase, glucuronidase, α-glucosidase, and α-fucosidase at 65°C.

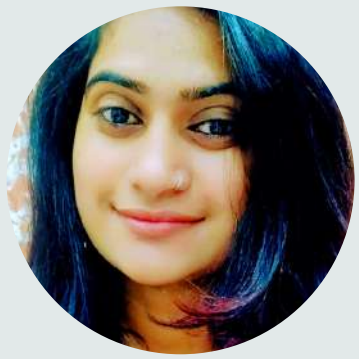
Acknowledgments

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Investigating the 2023 South Lhonak Lake Outburst in Sikkim: Dynamics, Triggers, and Impacts of a Himalayan GLOF Event

11

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Abstract

Glacial lake outburst floods (GLOFs) are destructive and threaten downstream communities in the Himalaya. We investigate the 2023 GLOF at South Lhonak Lake, Sikkim, India, focusing on glacial dynamics and geomorphic instabilities. Multi-temporal satellite data revealed a significant increase in glacier surface lowering from -0.19 m/year (1970–1983) to -0.87 m/year (2015–2023). Initially a supraglacial lake in 1962, it evolved into a moraine-dammed lake by 1983 and expanded 12-fold from 0.11 km^2 (1962) to 1.4 km^2 (2023). Our analysis shows gradual but increasing glacier retreat and calving, weakening the lateral moraines. Between 27 September and 6 October 2023, satellite imagery revealed an unusually strong retreat of 49.6 $\pm$ 7.1 m, indicating glacier calving and presence of massive icebergs visible on the lake. This, combined with intermittent rainfall triggered the moraine dam collapse and the GLOF. Post-event images showed loss of part of the north lateral moraine. These findings emphasize the need for long-term monitoring of Himalayan glacial lakes.

Assessment of Glacial Lake Dynamics and Outburst Flood Risk in Lachung Basin, Sikkim Himalaya Using Multi-Criteria Decision Analysis and Analytic Hierarchy Process

12

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Abstract

The current climatic phase is significantly affecting the global cryosphere, resulting in the incipient small glacial lakes, expansion of existing glacial lake areas and volumes, and a decline in permafrost coverage. This study aims to quantify glacial lake dynamics in the Lachung Basin of Sikkim, Eastern Himalaya, with a particular focus on potentially dangerous glacial lakes (PDGLs). Using satellite imagery and aerial photographs from 1974 to 2023 (area of >0.001 km^2), an updated inventory of glacial lakes was compiled. In 2023, a total of 99 lakes were identified, covering an area of 4.570 $\pm$ 0.29 km^2. Between 1974 and 2023, both the number (from 46 to 99) and total area (from 2.986 $\pm$ 0.10 km^2 to 4.570 $\pm$ 0.29 km^2) of glacial lakes grew substantially. A strong correlation was observed between glacial lake expansion and the accelerated rate of deglaciation from 2001 to 2014, with the highest recorded lake area expansion rate of 0.057 km^2/y in this basin. The expansion rate varied by lake type, with supraglacial lakes showing the lowest rate at 0.013 km^2 per year (1988-2001), while proglacial lakes expanded at a higher rate of 0.037 km^2/y over the same period.

The supraglacial lake at Tenbawa glacier has a history of Glacial Lake Outburst Floods (GLOFs) in 1998 and has been rapidly expanding since, likely due to climatic changes. Furthermore, other supraglacial lakes on Illibu Khangse glacier were identified as high-risk for GLOF events. Field mapping documented an unreported breach of a small moraine-dammed lake on August 2, 2023, which was later quantified through satellite imagery. To evaluate the outburst risk of PDGLs, 22 key determinants were analyzed using the Analytical Hierarchy Process (AHP), categorizing 24 identified PDGLs into three risk levels: 9 lakes were classified as very high risk, 12 as medium risk, and 3 as low risk. With nearly 88% of lakes falling into the medium to high-risk categories, urgent and precise bathymetric and geophysical assessments, permafrost evaluations, and continuous monitoring are essential for risk mitigation. It is crucial not to underestimate even small glacial lakes, as their potential breaches could lead to catastrophic cascading effects downstream.

13 Farmer's Flood Adaption Strategies in the face of climate change in the Chure– Terai Region of Nepal

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Abstract

The frequency and intensity of climate-induced disasters, such as floods, are increasing globally, and Nepal is no exception. Floods have a profound negative impact on agricultural production, exacerbating food insecurity and poverty. Despite this, studies on farmers' flood adaptation strategies are limited, especially in developing countries like Nepal, creating a huge knowledge gap. This paper aims to address that gap by exploring the variables influencing farmers' decisions on flood adaptation strategies through a cross-sectional household survey conducted in the Mohana–Khutiya and East Rapti River Basins in the Chure–Terai Region (CTR) of Nepal. The study's results show that 41% of farmers relocated assets as a pre-flood adaptation strategy.

House insurance was used as a pre-flood strategy only in the East Rapti River Basin. As post-flood coping strategies, approximately 71% of farm households used savings, and 11% sent their family members as temporary migrants. Additionally, households adopted seed and grain storage, cultivation techniques, and engineering and bioengineering measures. A Multivariate Probit analysis indicated that various variables, such as farmers' perception, socioeconomic characteristics (age, education, and household's proximity to road), farm characteristics (ownership, size, and livestock), and institutional conditions (access to irrigation, credit, and government relief programmes), had a significant impact on flood adaptation strategies. While the surveyed households demonstrated high levels of awareness of early warning systems, no correlation was observed between this awareness and flood adaptation strategies. Therefore, local governments need to consider these factors when developing policies and programmes for supporting farmers in adapting to flood risks.

14 The Fate of Biodiversity in a Changing Climate

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Abstract

Climate change poses an unprecedented threat to the biodiversity and ecological balance of the Himalayas, a global biodiversity hotspot. Our 487 species of chordates are threatened by the compounded impacts of habitat degradation, fragmentation, invasive species, and climate change. We present the multifaceted impacts of climate change on key species such as the Snow leopard (Panthera uncia), the Common Leopard (Panthera pardus), and the Royle's Pika (Ochotona roylii), highlighting the complex interactions between shifting habitats, species distribution, and human activities. Rising temperatures and glacial retreat have induced significant range shifts in both snow leopards and common leopards, leading to increased overlapping and intensified interspecies and human-wildlife conflicts, which jeopardize the survival of the endangered snow leopard. Concurrently, climate-driven upward shifts in tree lines and vegetation zones convert vital alpine pastures into forested areas, diminishing prey availability and altering habitat structure.

Additionally, the Royle's Pika, a small alpine mammal sensitive to snow cover and temperature variations, serves as a bioindicator of climate impacts. Rather than gradual warming alone, it is the increase in weather extremes, such as unpredictable snowfall, that critically undermines pika survival by disrupting its insulated winter habitat. This review underscores the interconnectedness of climate change effects on species, habitats, and human communities in the Himalayas, stressing the urgent need for integrated conservation strategies in the face of ongoing environmental change. These findings contribute to the objectives of the International Year of Glacier Preservation (IYGP) by elucidating the pressing biodiversity challenges posed by climate change in glaciated mountain ecosystems.

Background

The Hindu Kush Himalaya are a unique ecosystem and host four biodiversity hotspots. The biodiversity stats of the region show 41,001 species of plants, 14,286 species of fungi, 1,339 species of mammals, 3,874 species of birds, 837 species of reptiles, 438 species of amphibians, 78 species of freshwater fishes, and 26,351 species of insects (ICIMOD, 2025). These data were extracted from GBIF.org on April 2025, which is an estimate of only the species data published on the GBIF platform (Figure 1).

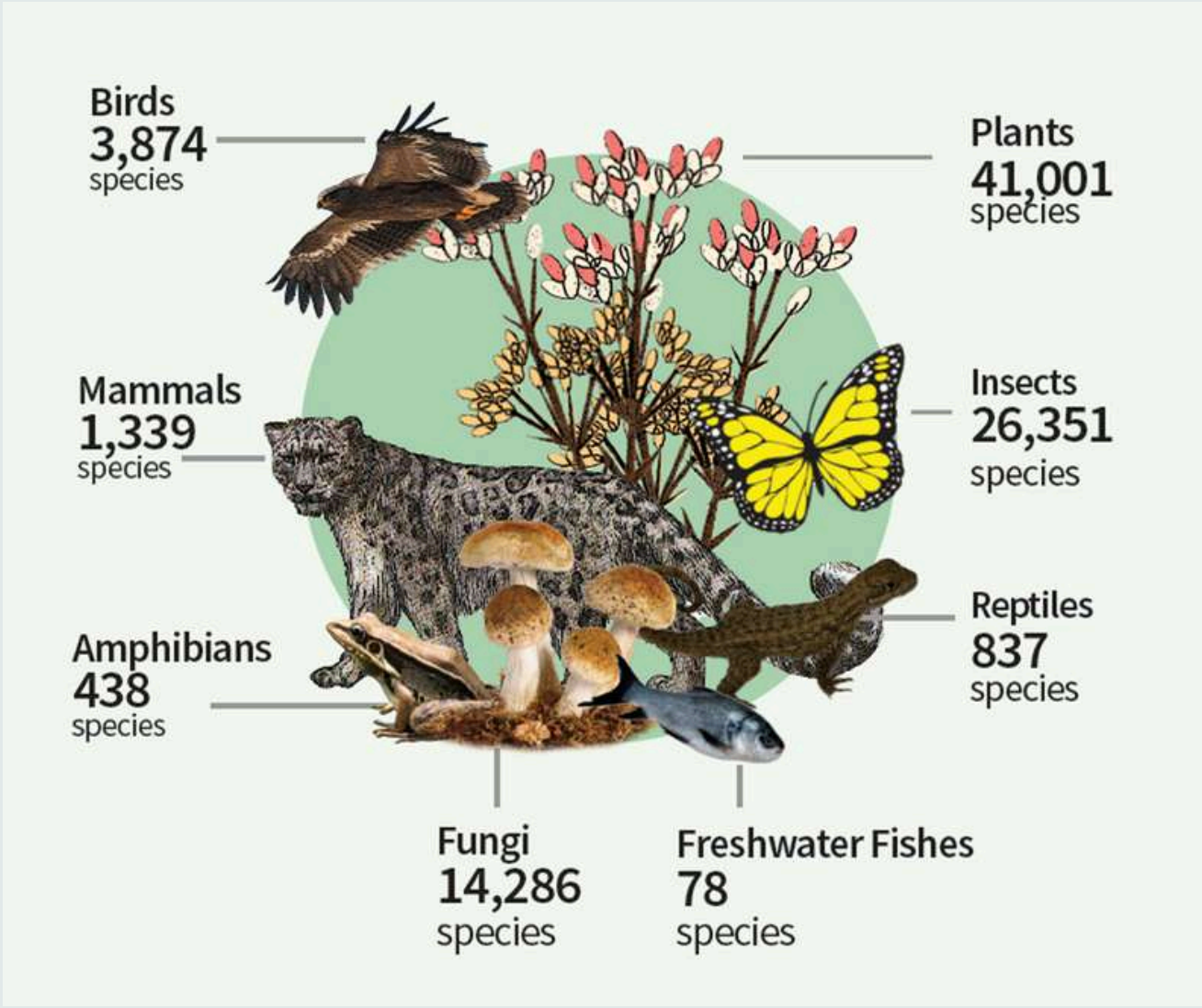


Figure 1: Biodiversity stats in Hindu Kush Himalaya Region (Ref: ICIMOD, 2025; Source: GBIF; Accessed on 25 April 2025)

In HKH, there are a total of 487 species belonging to the threatened category of the IUCN Red List of Threatened Taxa (Figure 2) (IUCN Red List of Threatened Species, 2025). This includes all chordates except for marine species.

1. Climate change-induced range shifts of Snow Leopard and Common Leopard

Climate change in the Himalayas has led to notable impacts on biodiversity, ecosystem functioning, ecosystem services, and livelihood (Kattel, 2022; Kunwar et al., 2023; Matta et al., 2025; Telwala et al., 2013). The Himalaya host a unique diversity of ecosystems and are highly vulnerable to climate change effects. Each 1.5°C increase in global temperature has a 0.3 to 0.7°C greater impact in the region (Krishnan et al., 2019).

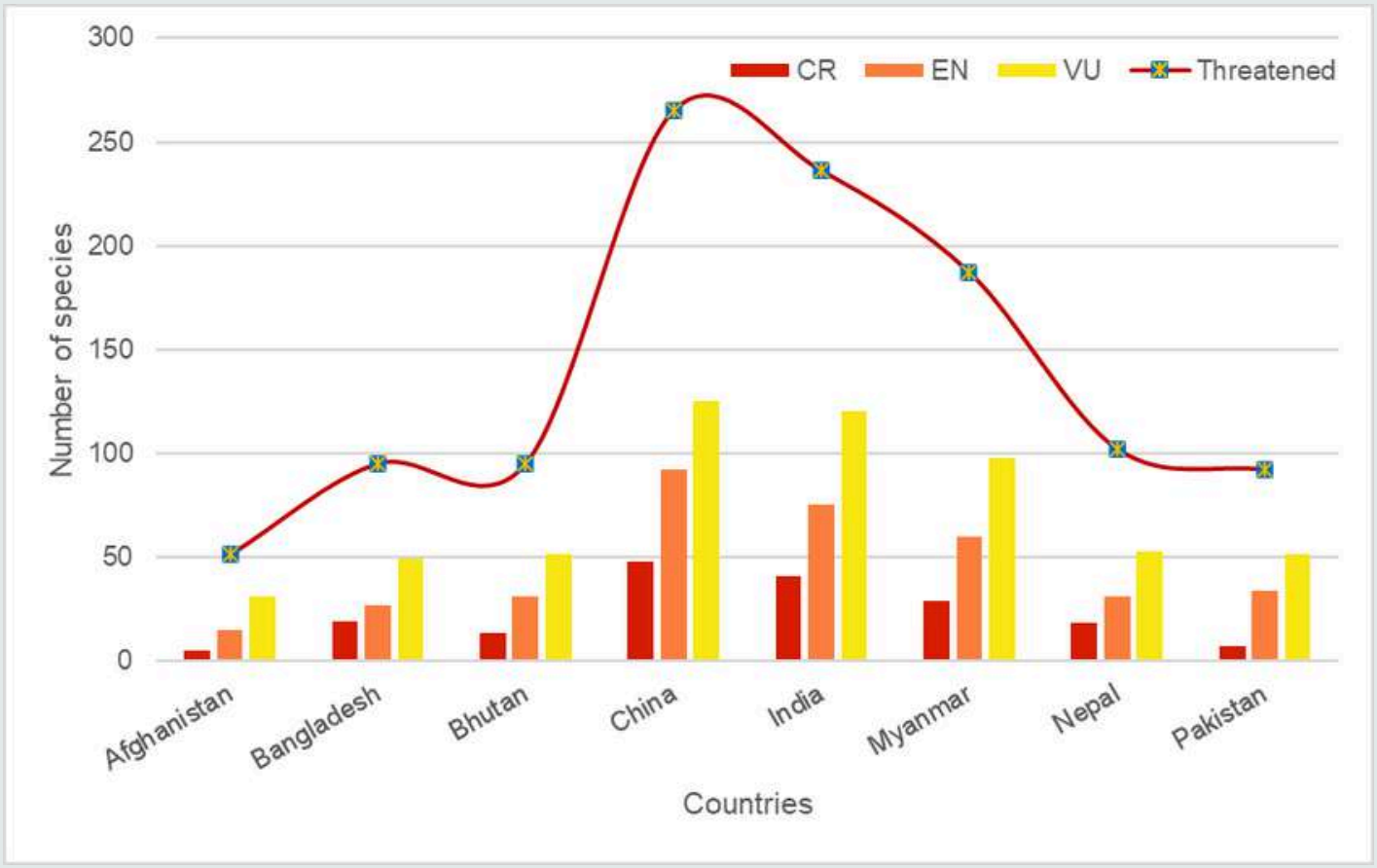


Figure 2: Threatened species of Hindu Kush Himalaya Region (Source: IUCN Red List; Accessed on 23 May 2025)

Thus, the Himalayas are also regarded as a climate change laboratory of the world (Chauhan et al., 2023). This has led to notable shifts in the distribution of large cat species, especially the snow leopard and the more generalist common leopard (Farrington & Li, 2016; Forrest et al., 2012; Zeng et al., 2022). These shifts require organisms' ability to maintain energetic balance and stress response in the face of changing environmental demands: climate change, anthropogenic pressure, and the spread of invasive species (Wingfield et al., 2015). The snow leopard, adapted to cold and high-altitude environments, is increasingly forced upward as temperatures rise and glacial ice retreats, restricting its suitable habitat (Forrest et al., 2012; Li et al., 2022; McCarthy et al., 2017). Meanwhile, the common leopard, a species that typically inhabits lower altitudes, is also moving to higher elevations due to warming and the upward shift of forests (Baral et al., 2023). This creates a novel zone of sympatry, intensifying competition for dwindling prey such as bharal and Himalayan tahr (Koju et al., 2024; Pal et al., 2022). Rising temperatures have triggered an upward migration of the alpine tree line, converting open meadows and grasslands critical for herbivores and livestock into shrublands and forests (Bhatta et al., 2025; Chhetri et al., 2018; Kumar & Khanduri, 2024; Shi et al., 2021). More critically, this overlap and tree line shifting have amplified human-wildlife conflict as both species encroach into livestock grazing areas and zones closer to human settlements (Baral et al., 2023; Koju et al., 2024; Pal et al., 2022). Conflict incidents such as livestock predation and retaliatory killings threaten snow leopard populations, already vulnerable due to low densities and slow reproductive rates (Aryal et al., 2014). These range shifts, driven by climate change among other anthropogenic pressures, represent a significant threat to snow leopard conservation, challenge coexistence strategies, and livelihoods in the Himalayas (Abrahms et al., 2023; Hani et al., 2024; Koju et al., 2024; Shrestha & Kindlmann, 2020).

2. Royle's Pika and the hidden threat of acute cold stress

Pikas are highly sensitive to climate variability, particularly to insulating winter snow cover and are thus regarded as bioindicators of climate change (Dahal et al., 2020). Royle's Pika (Ochotona roylii), a small, non-hibernating lagomorph, is restricted to talus slopes of the central and eastern Himalaya (2,400–5,200 m). The burrow and ambient temperature of Langtang never exceeded 25°C from 1988–2013; however, the inside burrow temperature in winter dropped below -5°C, a threshold linked to hypothermia risk for the species (Koju et al., 2021). This extreme temperature inside the burrow, because of variable snowfall, causes pikas to lose their winter thermal blanket, leading to death. This highlights a paradox: warming climates can intensify winter cold stress via the loss of insulating snow.

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15 Ecophysiological Resilience of Bryophytes in Sri Lanka: Adaptations to Tectonic, Climatic, and Anthropogenic Flux

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Abstract

Bryophytes, as a pioneer land plant group, are significant but underutilized components of ecosystem stability in Earth's dynamic systems. This study explores the ecophysiological adaptability of Sri Lankan bryophytes, a flora shaped by the complexities of tectonic uplift, monsoon oscillations, and human-induced land-use change. Focusing on mosses and liverworts in Sri Lanka, we tested their adaptive capacities under different microclimatic regimes. We constructed a custom climate chamber to replicate Sri Lanka's temperature variations and found that bryophyte communities were remarkably resilient to a selected temperature increase. These findings emphasize bryophytes' application as bioindicators of ecosystem health and their utility in restoration efforts across Central and South Asia's changing landscapes.

The study on bryophyte diversity changes with forest succession in Sri Lanka underscores the climatic sensitivity of these cryptogams to warming and precipitation variations—drivers accentuated by South Asian tectonic uplift and land use. We suggest that cryptogams serve as a sentinel of ecosystem vulnerability and propose their incorporation into climate-adaptation planning. This research also bridges gaps between geophysical processes and biotic adaptability, offering scalable approaches to monitor ecological change. It encourages integrating bryophyte-based models with regional climate-tectonic models to predict future biome shifts.

We also tested the germination efficacy of Pogonatum spp. (mosses) and spores of several liverwort species on both commercially available and specially prepared media. A commercially available medium supported the germination of Pogonatum spores but not liverworts, indicating taxon-specific requirements and highlighting the need for specially prepared growth media tailored to Sri Lanka's unique bryoflora. Initial experiments on a new growth medium indicate that pH stability, nutrient balance, and moisture retention are the most critical factors for successful germination, consistent with field observations in the Kottawa Rainforest.

Keywords: ecophysiology, Climate, Sri Lanka, Resilience, Growth media, anthropogenic disturbance

16 Linking Indonesian Gateway Restriction to Surface Hydrographic Changes in the Southeastern Indian Ocean Since the Latest Miocene.

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Abstract

This study examines the relationship between the ocean circulation dynamics in the eastern Indian Ocean and climate variability in Northwest (NW) Australia over the last 6.1 million years. The vertical water column of the southeastern Indian Ocean was analyzed using planktic foraminifera assemblages and oxygen and carbon isotope ratios of surface and subsurface dwelling foraminifera from Ocean Drilling Program (ODP) Site 763A. The X-ray fluorescence data of bulk sediment from ODP Site 763A was also used to understand variability in relative humidity and aridity in NW Australia associated with surface ocean warming.

The findings suggest a pronounced change in surface oceanography and climate in the region from 5.4 to 5 Ma, indicating a weak Leeuwin Current (LC) and reduction in mixed layer thickness. Subsequently, between 5.0 and 3.6 Ma, a strongly stratified water column with a thick mixed layer and deep thermocline emerged owing to the intensified Indonesian Throughflow (ITF). This led to a strengthened LC and diminished surface productivity, corresponding to a wet phase in NW Australia. The closure of the Indonesian Seaway during the Middle Pliocene (3.6–3.2 Ma) restricted the flow of West Pacific Warm Water into the Indian Ocean, weakened the LC, and intensified the dry phase in NW Australia. Significant shifts in planktic foraminifera abundances are observed in the early Pleistocene (2.6–1.2 Ma), perhaps linked to major changes in surface ocean circulation. During the Mid-Pleistocene Transition (1.2–0.6 Ma), the West Australian Current exerted a significant influence over Site 763A.

17 Unsteady Indian Monsoon and Evolving Climate Forcings during the Late Quaternary

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Abstract

The Indian Summer Monsoon (ISM) represents one of the most intricate components of the Earth's climate system. It contributes ~75–80% of annual precipitation across most of South Asia and displays a profound impact on regional hydrology, ecosystems, and the socio-economic sustainability of billions of people. Due to its critical importance, extensive efforts have been made through climate modeling and paleoclimatic reconstructions to examine the variability of the ISM across various timescales, as well as influencing forcings and mechanisms. However, our knowledge of the factors influencing ISM variability is still constrained by the scarcity of high-resolution paleoclimate records, especially from continental locations.

We have developed a suite of speleothem oxygen isotope ($\delta^{18}O$) records from the Himalayan region, suggesting significant ISM variability during the Late Quaternary. These records indicate enhanced summer monsoon precipitation during warmer intervals, like 292–287 kyr BP, 46-27 kyr BP, the Bølling–Allerød interval, the Early Holocene, Medieval climate anomaly, and the recent warm interval, mainly during the odd marine isotope stages (MIS). ISM conditions during MIS-3 remained moderate in the Indian subcontinent, indicating a disparity with another branch of the Asian monsoon, the East Asian summer monsoon. Conversely, diminished monsoonal intensity is evident during the Last Glacial Maximum (LGM), the Younger Dryas, Heinrich events, and the Little Ice Age. Interestingly, periods like the Little Ice Age, Heinrich events, and the Younger Dryas are associated with sudden decreases in ISM precipitation. Furthermore, extreme and sudden monsoon episodes seem to occur more frequently during periods of global warming, including the last three centuries.

The results indicate a varied dominance of forcings on the ISM across different temporal scales. While ISM variability is primarily governed by changes in solar insolation, coupling and decoupling of CO_2 concentrations with climate systems and North Atlantic Oscillations appear to exert a greater influence during colder climatic phases. Shorter-term fluctuations are modulated by internal climate modes such as the El Niño-Southern Oscillation, Pacific Decadal Oscillation, and Indian Ocean Dipole. Additionally, volcanic forcing has played a significant role in driving annual to decadal-scale variability. The interaction of these forcings has shaped the spatial and temporal dynamics of ISM behavior throughout the Late Quaternary and will continue influencing its future trajectory under ongoing climate change.

Technological solutions for strengthening climate resilience: Tackling land subsidence and sea level rise in Demak (Indonesia) and Satkira (Bagladesh) through innovative coastal adaptation

18

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Abstract

Coastal regions in Southeast and South Asia are increasingly vulnerable to the dual threats of land subsidence and sea level rise - phenomena that severely threaten the livelihoods, infrastructure, and ecosystems of low-lying deltaic areas. This paper presents a comparative analysis of technological and nature-based solutions implemented in Demak, Indonesia, and Satkhira, Bangladesh, to address the growing risks posed by these environmental challenges. Both regions represent frontline communities exposed to compound climate stressors, where traditional infrastructure solutions have proven insufficient and sometimes maladaptive in the face of dynamic coastal processes. In Demak, a regency located on the northern coast of Java, rapid land subsidence exacerbated by excessive groundwater extraction and sediment compaction has led to chronic tidal flooding, loss of agricultural land, and displacement of communities.

The Indonesian government, in partnership with civil society organizations and international donors, has piloted several adaptive technologies, including mangrove restoration through permeable brushwood structures, hybrid coastal defense systems, and sediment trapping installations. These efforts aim to stabilize coastlines while enhancing sediment accretion and supporting ecological recovery. Similarly, Satkhira, a coastal district in southwest Bangladesh bordering the Sundarbans mangrove forest, faces the confluence of relative sea level rise and salinity intrusion, which undermine agriculture, freshwater availability, and biodiversity. Here, integrated approaches such as climate-smart embankment retrofitting, tidal river management (TRM), and floating agriculture systems have been adopted. These initiatives not only provide physical protection but also promote adaptive livelihoods and local participation in climate resilience planning.

This study adopts a mixed-methods approach, combining geospatial analysis, field observations, policy review, and stakeholder interviews to assess the effectiveness, scalability, and socio-environmental impact of these technological interventions. The findings highlight that while engineered “grey” infrastructure remains relevant in specific contexts, the integration of nature-based solutions and local knowledge significantly enhances long-term adaptability and sustainability. Importantly, community engagement and cross-sectoral coordination emerged as critical success factors in both case studies.

Comparative analysis reveals that Demak’s emphasis on ecosystem-based adaptation aligns well with sediment dynamics, whereas Satkhira’s solutions reflect a stronger focus on livelihood diversification and hydrological interventions suited to the deltaic terrain. The success of these initiatives also hinges on enabling policy environments, institutional support, and sustained financing mechanisms.

The paper argues that climate adaptation in subsiding and sinking coastlines must transcend reactive engineering responses and shift toward adaptive, inclusive, and ecosystem-compatible strategies. Lessons from Demak and Satkhira offer valuable insights for other delta regions within the Global South facing similar challenges. Strengthening data integration (e.g., remote sensing, hydrodynamic modeling), promoting regional cooperation, and enhancing local capacity building are essential next steps to scale these efforts.

In conclusion, technological innovation—when rooted in local contexts and ecological understanding—can serve as a powerful tool to build resilience in climate-vulnerable coastal zones. Policymakers, researchers, and practitioners must continue to foster interdisciplinary approaches to ensure that adaptation strategies are not only effective in the short term but also equitable and sustainable in the long run.

Dynamics of Land use land cover (LULC) change and its effect on agriculture and water quality at Upazila level in Gazipur, Bangladesh

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Abstract

This study quantifies land use and land cover (LULC) changes over a 30-year period (1990, 2000, 2010, and 2020) and their effects on surface water quality and agricultural production in the Gazipur district of Bangladesh. LULC changes, driven by recent industrial development, unplanned urbanization, and population growth, directly impact the landscape, global climate, ecosystem services, and soil, water, and biotic health. For this study, Landsat images were processed using QGIS and ArcGIS to identify five LULC classes: forest, agri/grassland, water, built-up, and other land.

The results show that agri/grassland is the largest land use category, and its coverage is increasing. The built-up area increased sharply from 1990 to 2020, while "other land" (fallow or bare land) decreased from 10.14% to 1.16% in the same period. Meanwhile, forest coverage declined by 66.62%. Approximately 41,859.99 ha of forested area was converted to agri/grassland, 2,455.92 ha to built-up land, 316.26 ha to water, and 358.11 ha to other land types.

Water quality analysis revealed maximum average temperatures of 35.20°C (±2.63), EC of 1,423 µs/cm, and TDS of 746.5 mg/l in Kaliakoir Upazila. Dissolved Oxygen (DO) was found to be above 5 mg/l in Sreepur, Kapasia, and Kaliganj. The maximum average concentrations of heavy metals were observed in Kaliakoir Upazila for Pb (925.6917 µg/l), Mn (477.8625 µg/l), and Na (11,230.17 µg/l). The highest Fe concentration was in Sreepur Upazila (3,531.6 µg/l), followed by Sadar (1,496.517 µg/l). Maximum average Cd concentration was observed in Kapasia (41.28 µg/l), followed by Kaliakoir (30.8767 µg/l). Cu concentration was highest in Kaliganj (14.205 µg/l), followed by Sadar (6.29 µg/l) and Kaliakoir (3.893 µg/l). The maximum average concentrations of Ca (29,197.25 µg/l) and Mg (8,142.833 µg/l) were observed in Kaliganj, with the minimum in Sreepur. The overall order of heavy metal concentration in the study area is Ca > Na > Mg > Fe > Pb > Mn > Cd > Cu > Ni > Cr.

The average family size in the study area was 6.29, with a literacy rate of 72.2%. The average annual family income for farmers was BDT 69,822.78. Most farmers contacted the Department of Agricultural Extension (DAE) for services. Respondents opined that 61% of the cropland is near industry, and almost half of the total crop area is occupied by di-crop (48%), followed by polycrop (29%) and monocrop (23%). Farmers reported that forest and agricultural areas have been reduced for development, and polluted factory water is affecting crop production, biodiversity, and land fertility. They also noted increased crop production costs. However, from a positive perspective, respondents felt that industrial development improved their socioeconomic conditions by opening new income sources. Crop production has also increased due to the adoption of new high-yielding varieties and the practice of integrated farming, which has positively impacted farmers' income.

20 Exploration of Metallic Minerals Using Crowdmag in parts of Karshi, Nasarawa State, Nigeria



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Abstract

This study investigates the potential of the CrowdMag application, a citizen science tool leveraging smartphone magnetometers, for the preliminary exploration of metallic minerals in a part of Karshi, Nasarawa State, Nigeria. Traditional geophysical exploration methods can be resource-intensive and time-consuming. This research explores the feasibility and limitations of crowd-sourced magnetic data collected via the CrowdMag app to identify magnetic anomalies indicative of subsurface metallic mineral deposits. Magnetic data were acquired through systematic surveys within the study area, and these data were processed and analyzed to generate magnetic anomaly maps. The identified anomalies were then correlated with existing geological maps and known mineral occurrences in the region to assess the app's effectiveness in delineating potential mineralized zones. This study contributes to understanding the applicability of low-cost, community-driven approaches in early-stage mineral exploration, particularly in resource-constrained environments. The findings highlight the potential of CrowdMag as a supplementary tool for reconnaissance surveys and raising awareness about mineral resource potential within local communities, while acknowledging the need for further validation with more rigorous geophysical techniques.

21 Assessment of Heavy Metal Contamination in Surface Soils from Anthropogenic Sources: Ecological and Human Health Perspectives



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Abstract

Heavy metal contamination in surface soils poses a significant environmental and public health concern, especially in industrial zones. This study assesses the concentrations, sources, and associated ecological and health risks of heavy metals in soils collected near a urea fertilizer factory. Fifteen elements—K, Ca, Mg, Ti, Fe, Co, Cu, As, Zn, Rb, Sr, Zr, Pb, and Th - were analyzed using Energy Dispersive X-ray Fluorescence (EDXRF).The mean concentrations (mg/kg) of these metals were: Mg (14,712), K (11,828), Ca (8,607), Ti (4,378), Fe (47,358), Co (10.93), Cu (17.04), Zn (151.57), As (8.65), Rb (191.08), Sr (191.42), Zr (263.64), Pb (88.69), and Th (17.55). Pollution indices including geo-accumulation index (I_geo), enrichment factor (EF), and contamination factor (CF) indicated that the area ranged from practically uncontaminated to moderately contaminated, and from minimally to moderately enriched with these elements. Ecological risk, evaluated via the Risk Index (RI), was generally low. Multivariate statistical analyses—Principal Component Analysis (PCA) and Correlation Analysis (CA) - suggested both geogenic and anthropogenic sources contributed to the observed metal concentrations.Human health risk assessments through ingestion, inhalation, and dermal contact pathways showed hazard quotient (HQ) and hazard index (HI) values below 1, and total carcinogenic risk (TCR) values below 1E–06, indicating negligible health risks. However, children were identified as more susceptible to both carcinogenic and non-carcinogenic risks.Overall, the study highlights limited ecological and health risks but emphasizes the need for continuous monitoring and pollution control near industrial sites.

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Sustainable and Cost-Effective Hydrogen Generation Using Functional Panels

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Abstract

Photovoltaic (PV) electricity generation has gained substantial momentum as a preferred renewable energy solution, owing to its environmental friendliness and scalability. However, operational challenges such as surface overheating, inefficient thermal management, and underutilization of infrared (IR) photons still hinder optimal performance. This study addresses these limitations by investigating functional PV panels integrated with heat harvesting devices (HHDs), particularly Peltier-based systems, which offer a low-maintenance and cost-effective solution for panel cooling and energy recovery.

Three critical aspects are examined in detail: (i) maintaining the PV panel surface temperature within the optimal operating range, (ii) utilizing the waste heat generated during operation, and (iii) mitigating thermal load caused by unused IR radiation. The implementation of HHDs significantly improves the electrical efficiency of the PV system. Experimental data show that functional PV panels exhibit 1.2 to 1.5 times higher efficiency compared to standard commercial (blank) panels. Controlled laboratory tests using a solar simulator under uniform light intensity further validated these results. Additionally, the use of IR cut-off filters was found to enhance panel efficiency by approximately 0.8 times by effectively reducing unwanted thermal input.

The study also evaluates various cooling techniques to maintain lower and more stable operating temperatures, thereby improving the electrical conversion efficiency of PV modules. These findings highlight the potential for scalable integration of thermal management systems in PV technology to enhance power output and reduce operational degradation.

In parallel, the research explores sustainable hydrogen generation through saline water electrolysis powered by solar energy. Electrolysis offers a clean and straightforward method for hydrogen production and can be synergistically integrated with PV systems. A techno-economic assessment was conducted to evaluate the feasibility of donor-assisted electrolysis using seawater with a salt concentration of 3%. Hydrogen production was facilitated by varying concentrations of hydrogen peroxide as a donor agent under different voltage and current settings.

Notably, the study replaces expensive platinum (Pt) electrodes with cost-effective titanium-molybdenum (Ti-MMo) electrodes, operating in neutral media, which significantly reduces the overall system cost. The Levelised Cost of Hydrogen (LCOH) was analyzed based on electricity inputs from both thermal (₹8/kWh) and solar (₹2/kWh) sources, using an exchange rate of 1 USD = ₹83. The results demonstrate that this approach can substantially lower the energy demand and production cost of green hydrogen.

Overall, this study presents a dual approach to enhancing renewable energy systems—boosting photovoltaic efficiency and producing green hydrogen economically. The integration of advanced thermal management in PV panels and cost-effective electrolysis using seawater opens new avenues for sustainable energy generation. The findings offer valuable insights for engineers, policymakers, and investors aiming to promote cleaner energy technologies. By adopting the proposed strategies, significant progress can be made toward achieving energy sustainability, reducing carbon emissions, and advancing national energy security.

23 Effective Method of Digital Processing of Systems Media Resource of Business Entities

Saida Safibullayevna Beknazarova



Abstract

The article is devoted to effective methods of digital processing of media resources, with a focus on the image. It covers various techniques that can significantly improve the quality of images, extract important information, and apply visual effects. The description covers methods such as filtering and smoothing, contrast and brightness correction, object segmentation, frequency domain conversion, and the use of machine learning and artificial intelligence algorithms. Special attention is paid to modern approaches, including the use of neural networks and deep learning models to solve complex image processing problems. The article also covers the scope of application of etix technology in such areas as media, medicine, security and scientific research. The presented method and tool enable more efficient and accurate image analysis, as well as open up new horizons in the field of digital processing of media resources.

24 Regulating Hepatitis B Virus Replication through Endoplasmic Reticulum Stress Modulation

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Abstract

Hepatitis B virus (HBV) resistant to several antiviral drugs due to viral genomic mutations, has been reported which aggravates chronic infection and leads to hepatocellular carcinoma. Therefore, host cellular factors/signaling modulation might be an alternative way of treatment for drug-resistant HBV. Here, we investigated the viral protein expression, replication, and virion production using endoplasmic reticulum (ER) stress-modulating chemicals; tunicamycin (an ER-stress inducer) and salubrinal (an ER-stress inhibitor). We found that ER stress could be induced by HBV replication in transfected HepG2 cells as well as by tunicamycin as demonstrated by dual luciferase assay. HBV intracellular core-associated DNA quantified by qPCR has been significantly increased by tunicamycin in transfected HepG2 cells.

Inversely, intracellular core associated and extracellular particle DNA has been significantly decreased in a dose-dependent manner in salubrinal-treated HepG2 cells transfected with HBV replicating plasmid pHBI. Similar results were found in stably HBV-expressing hepatoblastoma (HB611) cells treated with salubrinal. However, increased or decreased ER stress by tunicamycin or salubrinal treatment respectively has been confirmed by expression analysis of grp78 using Western blot. In addition, Western blot results demonstrated that expression of HBV core protein and large HBsAg is increased and decreased by tunicamycin and salubrinal respectively. In conclusion, the sal-mediated inhibition of the HBV replication and virion production might be due to the simultaneous reduction of core and large HBsAg expression and maintaining the ER homeostasis. These results of HBV replication regulation by modulation of ER stress dynamics would be useful for designing/identifying anti-HBV drugs targeting cellular signaling pathways.

25 Unique and adaptive evolution in LMIC health system response for TB and COVID-19 diagnostic for impoverished travelers

Farzana Zaman, National Tuberculosis Control Program



Abstract

Background
The current COVID-19 situation with continuous emergence of new variants has affected largely on the aviation system and international travel. Quarantine and proper testing of incoming travelers are considered as the most important preventive strategy so far. However, many unprecedented challenges have been observed at the resource poor settings such as inadequate airport quarantine facilities, lack of highly sensitive but rapid testing and cost-effective management system. In this current study, we present a cost-effective and timely alternative diagnostic and quarantine facility for the incoming impoverished travelers in Bangladesh.
Methods
We conducted a cross-sectional serosurvey from December 15, 2020 to November 30, 2021 for inbound travelers from different countries to Bangladesh. These impoverished travelers (unable to afford hotel quarantine) were quarantined in Hajj camp (a government facility near the airport reserved for muslim pilgrims) with full coverage of food and lodging at subsidized cost and free testing by GeneXpert, which is capable of Nucleic Acid Amplification Test (NAAT) for both COVID-19 and Tuberculosis (TB).
Results
Most of our study participants were male (74.32%) and the predominant age group was 20-40 years (Figure 1). Total SARS-COV-2 positive patients were 106 (7.98%) among 1328 participants out of which 72 were male. The highest infection rate was observed in travelers from Singapore (n=16/71, 22.53%) followed by USA and Malaysia (Figure 2). The result processing time was only 1 hour for the NAAT and 1222 participants (92%) were able to travel to their destinations on the same day. The positive cases were kept in quarantine for further assessment. Majority of the participants (95%) were satisfied with the service and processing time.

Conclusions
The current study is a good example of implementation research in resource poor settings. Our study findings support the equitable access to COVID-19 diagnostics for disadvantaged group and emergency preparedness for similar respiratory viral pandemics through optimum use of existing health system resources. Due to high sensitivity and specificity, NAAT is also recommended by WHO for diagnosis of acute COVID-19 cases as well. Therefore, our research also emphasizes on the potential to equip hard to reach laboratory facilities by GeneXpert for both TB and COVID-19 diagnostics specially where the double burden exists which is cost-effective and highly sensitive as well.

26 Testing and Scaling Messaging for Hpv Vaccine Uptakei in Bangladesh through a Nation-Wide Awareness Campaign

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Introduction

Cervical cancer is mostly prevalent in low- and middle-income countries (LMICs), where incidence accounts for 85% and 90% of related mortality. In Bangladesh, cervical cancer is the second most common cancer in females. The prediction is that without any intervention a total of 505,703 women in Bangladesh will die from cervical cancer by the year 2070. To reduce the burden, government launched the Human Papillomavirus (HPV) vaccination campaign on 2nd October 2023 among 10 to 14 years old girls. This study aimed to evaluate the knowledge gap, social barrier and develop an effective strategy for social mobilization to scale up the HPV vaccine coverage of the country.

Methods

This study is a cross-sectional mixed-method survey with a duration of two years. The target population for the awareness program and survey will be schoolgirls class 5 to 9, parents, teachers. A structured questionnaire form will be given to the participants before the awareness campaign to assess the baseline knowledge and after the program to evaluate the impact of the campaign. All categories of education from urban, rural, and hard reach set up will be included. Statistical analyses will be done to evaluate the impact between these groups.

Results

Until now in this study, a total of 2039 respondents participated. In the case of pre-awareness survey, about 73.91% of the respondents had knowledge on vaccination of cervical cancer or human Papillomavirus (HPV). In both pre-and post-awareness survey, majority identify that not knowing about HPV vaccination center as major barrier. Overall, this ongoing campaign increased acceptance of HPV vaccination 90% so far.

Conclusions

Programs for HPV vaccination will be more effective and successful if mobilization efforts concentrate on raising awareness, giving accurate information, promoting acceptance, and maintaining demand for the vaccine.

Keyword: HPV Vaccination, Knowledge, Social Barrier.

Detection of Inborn Errors of Metabolism using Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS) among high-risk neonates and Children in Bangladesh

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Introduction

Inborn Errors of Metabolism (IEMs) are a group of inherited metabolic disorders. These metabolic disorders are caused by mutations in the genes that encode enzymes of the metabolic pathways. It is assumed that 6-8% of the world population can be affected by IEMs where the prevalence of IEM among suspected patients is 2.6% in Bangladesh. Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS) is an accurate and reliable approach for the diagnosis of IEMs. So, we aimed to determine the prevalence of IEMs among Bangladeshi children using LC-MS/MS along with the common types of IEM, their age-specific prevalence, clinical profiles, and treatment patterns.

Method

A total of 570 healthy participants and 273 suspected patients with IEMs were enrolled in the study. Quantification of amino acids and acylcarnitine was performed on an automated LC-MS/MS system using dried blood spots (DBS) cards. Data were analyzed using established methods.

Result:

Among 273 clinically suspected patients with IEMs, 7 were screened positive for 6 different IEMs by LC-MS/MS analysis where 3 cases with phenylketonuria, 1 with citrullinemia type II, 1 with methylmalonic acidemia, 1 with isovaleric acidemia and 1 with carnitine uptake defect.

Conclusion:

LC-MS/MS technique makes it possible to screen for a wide range of previously unscreened inborn errors of metabolism (IEMs) using a single test. LC-MS/MS technique may play a vital role in screening and diagnosis of IEMs in newborns and this may be helpful in facilitating timely therapy of treatable IEMs. Unfortunately, this high-throughput technique is very rare in our country. As a result, biological specimens from suspected individuals are sent to other countries. We hope our study will assist other researchers or government authorities in installing and establishing this new technology for screening IEMs through newborn programs.

Keywords: Infant, Inborn Errors, Newborn, Liquid, Chromatography, Tandem mass spectrometry, metabolism, Bangladesh.

ABOUT TWAS CASAREP

The World Academy of Sciences Central and South Asia Regional Partner (TWAS CASAREP) is hosted at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru, India. It was established in 2003, initially as TWAS ROCASA, with the vision of fostering scientific excellence and advancing collaboration across the Central and South Asian region.

Prof. V. Krishnan, TWAS member and former President of JNCASR, served as the first Coordinator of TWAS CASAREP (2003 to 2022). His efforts laid the foundation for its activities and significantly enhanced its visibility and institutional strength. He was succeeded by Prof. M. R. S. Rao (2022 to 2023). The TWAS CASAREP is currently led by Prof. G. U. Kulkarni (2024 to present), a TWAS member, along with Dr. Jaishri Sanwal Bhatt since 2023.

The countries covered under this Region are Afghanistan, Azerbaijan, Bangladesh, India, Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Maldives, Nepal, Pakistan, Sri Lanka, Tajikistan, Türkiye, Turkmenistan, and Uzbekistan. TWAS CASAREP provides a strong platform for scientists to connect, exchange knowledge, and address regional and global challenges of sustainable development through science, technology, and innovation.

Each year, TWAS CASAREP selects five TWAS Young Affiliates, outstanding early-career researchers who join a vibrant network of promising scientific leaders from the developing world. These young scientists contribute fresh perspectives, energy, and vision to the Academy. In addition, TWAS CASAREP organizes scientific meetings, training programs, and capacity-building activities, fostering regional collaboration and strengthening links with the global scientific community.

TWAS CASAREP remains deeply committed to advancing excellence in science and empowering the next generation of researchers to contribute to sustainable development in Central and South Asia. Its efforts focus on expanding activities, fostering stronger collaborations, and broadening its impact in promoting scientific advancement, capacity building, and regional cooperation across the region.

Registered Participants (In-person & Online)

Participants attending in person are marked in red

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