

International Virtual Workshop on Global Seismology and Tectonics

(IVWGST – 2022)
20 – 30, September 2022



e-Abstract

Volume - III



Organized By
Geosciences & Technology Division
CSIR-North East Institute of Science and Technology
Jorhat, Assam-785006 (India)



Namaskar

This e-Abstract Volume of International Virtual Workshop on Global Seismology and Tectonics - 2022 (IVWGST-2022) was inaugurated by Honourable Director of CSIR-NEIST Jorhat, Dr G. Narahari Sastry, FNA, FASc, FNASc, FRSC on 30th of September, 2022 during the valedictory session of IVWGST-2022 in the presence of Dr. Andrew J. Michael, USGS, USA; Prof. Dapeng Zhao, Tohoku University, Japan; Prof J. R. Kayal, Former DDG, GSI, Govt of India; Dr. Manoj K Phukan, CSIR-NEIST; Dr. Santanu Baruah, Convenor (IVWGST-2022), CSIR-NEIST and other technical staff members and online participants.



Director of CSIR-NEIST, Jorhat

Dr G Narahari Sastry has obtained his early education in Khammam, Telangana and obtained his B.Sc. and M.Sc. from Osmania University (campus), Andhra Pradesh and Ph.D from University of Hyderabad. After a couple of post- doctoral stints, he started his independent research career in 1997 at Pondicherry University, and moved to CSIR-NEIST in 2002, to head centre for molecular modeling. He is a professor of AcSIR in chemistry and lifesciences disciplines. Dr Sastry's research interests are theoretical and computational chemistry, computational biology, computer aided molecular design and chemoinformatics. Dr Sastry has made fundamental contributions in the area of noncovalent interactions and developed several important concepts in this area. His group is interested to apply the data science approaches, and developing indigenous software, Molecular Property Diagnostic Suite. Several of his computational predictions have seen experimental realization. Besides publishing independently, the group also has active collaboration with several experimentalists and strongly believe that 'theory experiment interplay is indispensable' for the progress of science. He has successfully guided 27 Ph.D students and published more than 300 papers. Currently more than 10 members are doing Ph.D and postdoctoral studies in the group. These publications received over 11,596 citations, with an h-index of 53. Dr Sastry is a J. C. Bose National Fellow (2015). He was

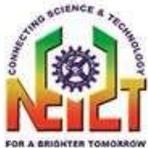
awarded with Shanthi Swarup Bhatnagar Prize in Chemical Sciences (2011), considered as one of the highest prize for science and engineering in India, National Bioscience award (DBT) 2009, one of the highest for Lifesciences in India, Swarnajayanthi Fellowship 2005 (DST), B.M. Birla award for 2001, B C Deb Memorial award (2009), CRSI Medal 2011, and AvH Fellowship. He has delivered more than 350 invited lectures which include talks in national and international conferences. He was a visiting professor at IMS, Japan; LMU, Munich, Germany; Jackson State University, USA, and Kyushu University, Japan. He was elected as a Fellow of the Royal Society of Chemistry (FRSC), Fellow of the INSA (FNA), Fellow of National Academy of Sciences (FNASc), and Fellow of the Indian Academy of Sciences (FASc), Fellow of Association of Biotechnology and Pharmacy, Telangana State Academy of Sciences (Founder Fellow) and Andhra Pradesh Academy of Sciences (FAPAS). He is a regular reviewer to some prestigious journals and also in the editorial board of some journals.

Dr. G. Narahari Sastry

FNA, FASc, FNASc, FRSC



Alma mater	Osmania University, University of Hyderabad
Fields of Research	Chemistry, theoretical chemistry, computational biology, computer aided molecular design, chemoinformatics.
Institutions	CSIR-North East Institute of Science & Technology, Jorhat ; Indian Institute of Chemical Technology; Pondicherry University
Prizes and honours	J C Bose National Fellow (2015), Shanti Swarup Bhatnagar Prize in Chemical Sciences (2011), CRSI Medal (2011), B C Deb Memorial award (2009), National Bioscience award (DBT) (2009), Swarnajayanthi Fellowship 2005 (DST), B.M. Birla award (2001), avH Fellowship.
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सीएसआईआर- उत्तर पूर्व विज्ञान तथा प्रौद्योगिकी संस्थान
वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्
जोरहाट-785006, आसाम, भारत



Dr. G Narahari Sastry

DIRECTOR

FNA, FASc, FNASc, FRSC

CSIR-NORTH EAST INSTITUTE OF SCIENCE & TECHNOLOGY

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)

JORHAT-785006, ASSAM, INDIA

17 September 2022

e-Welcome Message

Warm greetings from CSIR NEIST!

IVWGST-2022 is the third episode of the virtual workshop series which started during the pandemic year of 2020. It is one of the examples of opportunity in adversity that our institution has carved out of the COVID- 19 pandemic situation with the aim to boost the morale of the students and researchers, during the distressing pandemic situation, by provisioning opportunities to interact with eminent personalities of their research interest in the domain of Seismology and Tectonics.

I welcome and appreciate the jubilant participation of all the students, researchers, scientists and academicians who have registered for IVWGST-2022. It is a matter of pride that about 528 participants from more than 17 countries have registered for the event. I would like to thank and commend each and every keynote speaker from recognized global institutions for their philanthropic contribution to promote scientific vigor and knowledge dissemination. I am very confident that the sessions throughout the course of the workshop will immensely augment the inquisitive temper of the students towards pursuing research and higher education. The workshop features highly intuitive sessions discussing diverse aspects of seismology and tectonics- from seismic hazard assessment to public policy, computational techniques to precursory appraisal, tectonic modelling and interpretation to studying kinematics of complex tectonic regimes of the world, etc.

The e-Abstract volume compiles the abstract of all the sessions for aiding the participants to easily refer to the workshop discourse. The e-Abstract volume also documents research abstract submitted by the participants mainly from the broad domains of Geology, Geophysics and Physics. It would serve as a medium of propagation of research erudition across global geoscience forums. I thank all contributors who have submitted an abstract for the volume.

I congratulate the convener, Dr. Santanu Baruah and his team for successfully organizing the flagship event under the aegis of the **Diamond Jubilee** celebration of CSIR-NEIST. Thanks to Dr. M K Phukan for his active role in organizing IVWGST-2022. I am also thankful to the Chief Patron, International Advisor, Session Advisor, Session Chairman and co-chairman for their kind assistance during the course of the workshop.

G Narahari Sastry



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e-Message from Chief Adviser

September 10, 2022

Our science is inherently global and so, if we are to fulfill our joint goals of understanding the Earth and reducing the suffering due to earthquakes, we must learn from each other. The pandemic has pushed us to find new ways to connect and the development of the International Virtual Workshop on Global Seismology & Tectonics in 2020 by CSIR-NEIST was a most impressive response. By bringing together over 1,000 people from at least 30 countries, the organizers supported students and researchers, all over the world, in our shared endeavor.

Thus, it is my great honor to be the International Advisor to the International Virtual Workshop on Global Seismology & Tectonics-2022. Due to the amazing work by the organizers, this year's workshop is even larger and includes over 528 students and researchers from 17 countries. There is no doubt that this flagship event of CSIR-NEIST will boost the morale of the students and researchers, during this distressing pandemic, and will support their critical work on seismology and tectonics.

I appreciate everyone is who participating in IVWGST-2022. I am thankful to all the keynote speakers, representing different countries, institutions, and a wide array of scientific topics, for volunteering to disseminate critical knowledge and skills within the broad domain of Seismology and Tectonics. Their passion and interest towards promulgating advanced techniques and scientific information are greatly appreciated.

The e-Abstract volume will document the talks presented during IVWGT-2022's live webinar series. It also provides an overview of research being done by many of the participants. The e-abstract volume will be distributed and read by a widescientific community, connecting us together across the globe. I thank all authors who have submitted an abstract to be included in the e-abstract volume.

At the USGS, we always appreciate the opportunity to share our work with students and colleagues around the world. Thus, I express my sincere thanks and gratitude to Prof G N Sastry, Director, CSIR-NEIST, Jorhat, Assam for extending his generous support, encouragement and guidance for this venture on national and international collaboration, the IVWGST- 2022. I am thankful to members of our advisory board, Organizing committee, Convener, Co-convener, Technical Committee, Moderators and associate Members for their hard work and acumen towards IVGWT-2022. A global event of this scope requires the coordination of many skills, each of which is appreciated. Particular thanks in this regard go to the Geoscience and Technology Division, CSIR-NEIST for creating IVGWST-2022.

And now onto the lectures and vigorous discussions after each one. I look forward to hearing new ideas, and fully expect that IVGWST-2022 will immensely augment each of our skills and expertise. And thus, I thank every participant for being part of this great event.

Sincerely

Andrew J. Michael



東北大学大学院理学研究科

地震・噴火予知研究観測センター

e-Message from International Adviser

The 3rd International Virtual Workshop on Global Seismology & Tectonics (IVGWT-2022), September 20-30, 2022 was a great effort, first of its kind, by the Geoscience and Technology Division, CSIR-NEIST to disseminate knowledge and experience to the undergraduate/post-graduate/Ph.D. students, young researchers, scientists and earthquake engineers. The IVWGST-2022 addressed basic problems towards global as well as local earthquake seismology and tectonics.

I express my sincere thanks and gratitude to Prof. G.N. Sastry, Director, CSIR-NEIST, Jorhat, Assam for extending his generous support, encouragement and guidance for this venture. I thank the participants for their keen interest and active participation at the IVWGST-2022. Sincere thanks to Dr. Santanu Baruah, Convener, IVWGST-2022, for his innovative thoughts, strategies and enormous efforts and patience in developing strong working relationships among scientific communities in different parts of the world. I highly appreciate the working group behind the IVWGST-2022 and the members of the Geoscience and Technology Division, CSIR-NEIST.

This e-Abstract Volume covers abstracts of all the lectures presented at the IVWGST-2022, live webinar series. It is well documented with the informative materials provided by the speakers. I convey my sincere thanks to all the authors and speakers who have contributed to the e-Abstract Volume. My sincere thanks and gratitude to the Advisory Board, Organizing Committee, Convener, Co-conveners, Technical Committee, Moderators and the associate Members for their persistent untiring efforts to make the IVWGST-2022 not only a great success but also in achieving a milestone to knowledge dissemination to the younger generation in India and abroad.

赵大鹏 赵
Dapeng Zhao

Dapeng Zhao, Professor of Geophysics
Tohoku University, Sendai, Japan

Prof. J. R. Kayal, M. Sc. (IIT-ISM), Ph. D. (VUW, N Z)

Former Deputy Director General (Head, Geophys), Geol Surv India, Kolkata

Ex Visiting Scientist: University of Leeds, UK; USGS, California;

Ehime University & University of Tokyo, Japan; Strasbourg University, France;

IPE, Moscow, Russia and GFZ, Potsdam, Germany

& CSIR Emeritus Professor, Jadavpur University, Kolkata, India

Ex Adjunct Professor: IIT-Kgp, IIT-ISM, ISR, Tezpur Univ, Manipur Univ.

Ex Guest Faculty: UNESCO & ICTP Training Courses, South Asia

Presently Guest Faculty: NIT, Agartala, India

Member of Advisory Committee: WIHG, NHPC, AERB & NPCIL, India

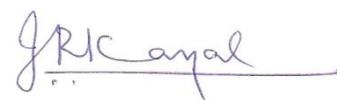
Message from the Session Chairman

September 18, 2022

The International Virtual Workshop on Global Seismology and Tectonics - 2022 (IVWGST-2022) being organized via online mode by the Geoscience and Technology Division of the CSIR-Northeast Institute of Science and Technology (CSIR-NEIST), Jorhat is a magnanimous endeavor of its kind. The workshop would, indeed, serve as an immense boon for the students, young researchers and professionals during this difficult pandemic situation. The Northeast Region (NER) of India as well as its adjoining areas is seismically one of the most active zones in the world due to the Himalayan collision to the north and atypical Indo-Burma subduction tectonics to the east. The seismic hazards and loss to human lives can be minimized with state-of-art scientific knowledge and awareness. The IVWGST-2022 is well designed to enhance our knowledge through the brainstorming sessions that include understanding the large, great and mega earthquake processes, translation of scientific knowledge to tools for societal benefits, and dissemination of knowledge to the young students, researchers and professional.

The e-abstract volume documents the IVWGST-2022 Workshop proceedings authored by the eminent resource persons from esteemed global institutions. I extend my sincere thanks and regards to all the resource persons for their contributions with rich knowledge, experiences and insights. The volume also compiles abstracts of young researchers around the world encompassing diverse geoscience topics.

I would like to extend my heartiest congratulations to the Convener, Dr. Santanu Baruah and his formidable team for organizing such a glorious Workshop that benefit some 1000 registered participants from some 17 countries. I also warmly appreciate the leadership and guidance of Dr. G. Narahari Sastry, Director, CSIR-NEIST for conceptualization of such educative Workshop with full support.



(J R Kayal)

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e-Message from the Convener

I am highly delighted to release the e-Abstract volume of the second International Virtual Workshop on Global Seismology and Tectonics (IVWGST-2022) organized by CSIR-NEIST under the aegis of the diamond jubilee celebration year of the institution. The annually recurrent virtual workshop is organized to ease the stress and impact of the pandemic manifestations on the students, and the scientific and academic community associated with Geosciences domain by creating a conduit for direct interaction with several eminent personalities from distinguished global geosciences forums and institutions of the world. More than 1750 participants, mostly students, registered for IVWGST-2022 from Algeria, Australia, Bangladesh, Brazil, Cameroon, Canada, Chile, Colombia, Croatia, Democratic Republic of Congo, Ecuador, Egypt, Ethiopia, Germany, Ghana, Iceland, India, Indonesia, Iran, Iraq, Italy, Japan, Malaysia, Malta, Nepal, Nigeria, Norway, Peru, Philippines, Portugal, Singapore, South Sudan, Sri Lanka, Taiwan, Tanzania, Trinidad & Tobago, Turkey, United Arab Emirates, Uruguay, United States of America and Venezuela.

The workshop featured keynote speakers from diverse geosciences forums and institutes of the world. We were honored to have Dr. Sailesh Nayak, Director, NIAS, India; Dr. Abhijit Ghosh, University of California; Dr. Jeanne Hardebeck, USGS, USA; Dr. Dapeng Zhao, Tohoku University; Dr. C. P. Rajendran, NIAS, Bengaluru; Dr. Sukanto Roy, Director, BGRL (MoES), India; Dr. Margarita Segou, British Geological Survey, UK; Dr. Summer Chopra, Director, ISr-Gujarat; Dr. Sridevi Jade, Head, CSIR-4PI, India; Dr. Justin Rubinstein, USGS; Dr. Wiwit Suryanto, UGM, Indonesia; Dr. Sagarika Mukhopadhyay, IIT-Rorkee, India and Dr. Julian J. Bommer, Imperial College, London as the keynote speakers for IVWGST-2022.

The e-abstract volume presents the session abstracts of all the keynote speakers and followed by a compilation of classical and contemporary research endeavors primarily in the field of Geology, Geophysics and Physics submitted by the participants. As the convener of the conference, I extend my gratitude to Dr. G Narahari Sastry, Director CSIR-NEIST Jorhat for his kind ubiquitous help and guidance in organizing this event. Working under his profound management is indeed a matter of great opportunity and privilege for me. I would also like to thank Dr. Andrew Michael, USGS, Dr. Dapeng Zhao, Tohoku University, Dr. J R Kayal, Former DyDG, GSI; Dr. Alan K. Kafka, Boston College, USA; Prof. H. K. Gupta, Geological Society of India; Dr. V. M. Tiwari, Director, CSIR-NGRI, India; Dr. O. P. Mishra, Director, NCS-New Delhi, India; Dr. K. Sain, Director, WIHG-Dehradun, India; Dr. Wiwit Suryanto, Gadhja Madha University, Indonesia; Dr. D. Hazarika, WIHG-Dehradun, India; Dr. B. K. Choudhury, CSIR-NEIST, India; Dr. Jatin Kalita, Head, RPBD, CSIR NEIST, Dr. Manoj K Phukan, GSTD, Mr. J L Khongsai, AO, CSIR-NEIST & Mr. Rama S. Sharma, CoFA, CSIR-NEIST for their valuable support and guidance.

I thank all the members of the organizing committee for extending their valuable time in organizing the program and all the authors, reviewers, and other contributors for their sparkling efforts and their belief in the excellence of IVWGST-2022.



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हम हिंदी में पत्राचार का स्वागत करते हैं



*e-Abstract Volume for International Virtual Workshop on
Global Seismology & Tectonics-2022*

- Published By:** **THE ORGANIZING COMMITTEE**
3rd INTERNATIONAL VIRTUAL WORKSHOP ON GLOBAL SEISMOLOGY & TECTONICS -2022 (IVWGST-2022)
20-30 SEPTEMBER, 2022
- Chief Patron:** *Dr. G. Narahari Sastry, Director, CSIR-NEIST, Jorhat, India*
- Chief Adviser:** *Dr. Andrew J. Michael, USGS, USA*
- Adviser:** *Prof J. R. Kayal, Former D.G., GSI, India*
Prof Dapeng Zhao, Tohoku University, Japan
- Advisory Board:** *Dr. Jatin Kalita, CSIR-NEIST, Jorhat, India*
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Dr. Timangshu Chetia, CSIR-NEIST, Jorhat, India



3rd International Virtual Workshop on Global Seismology & Tectonics

20-30th September 2022



Institute at a Glance:

North East Institute of Science and Technology (NEIST), Jorhat, Assam, a constituent establishment of Council of Scientific and Industrial Research (CSIR), New Delhi, has been engaged in multidisciplinary R&D work relevant to the country in general and North East of India (NE India) in particular. The Geoscience & Technology Division (GSTD) of CSIR-NEIST has been involved in monitoring the seismicity of NE India since 1982. Seismic hazard and vulnerability assessment of the populated cities and urban areas in NE India and propagating seismic hazard awareness have been some of the major programs of the division, apart from conducting geotechnical/geophysical consultancy services.

Aim of the Virtual Workshop:

Due to several physical communication constraints brought about by the COVID-19 pandemic situation, the practice of disseminating knowledge and ideas through webinar, a live interactive event where attendees join via their desktop or mobile device over the internet, have significantly proliferated. While research activities, including research exchange and collaborations, during this unprecedented situation have decelerated, it is imperative to boost the morale of the students and researchers by providing opportunities to interact with eminent personalities of their research interest. In accordance with this, the Geoscience & Technology Division (GSTD) of CSIR-NEIST Jorhat would like to conduct the 3rd INTERNATIONAL VIRTUAL WORKSHOP on "Global Seismology & Tectonics" series targeting the geosciences students and community, during 20-30 September, 2022.

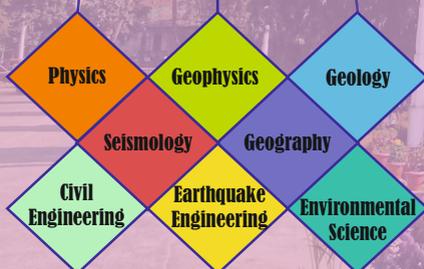
The lecture sessions aim to impart important information on emergent and impending topics of Seismology and Tectonics, involving case studies from seismically active zones of the world. The eminent keynote speakers of the workshop represent diverse geosciences forums and institutes or institutional departments across the world, including the United States Geological Survey, National Center for Seismology and Tohoku University.



Workshop Info.

Registration Starts: 05th August 2022
Registration Closes: 20th August 2022
Acceptance: 15th Sept. 2022
Inauguration: 20th Sept. 2022
Time: 09:30 am IST, +5:30 hrs GMT
Registration Fee: Nil (Free)

Targeted Discipline



Targeted Group



Registration/Workshop Link

Telegram Group		
	Scan QR Code	Click Here
Registration Link for International Participants		
	Scan QR Code	Click Here
Registration Link for Indian Participants		
	Scan QR Code	Click Here



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3rd International Virtual Workshop on Global Seismology & Tectonics

20-30th September 2022

Webinar Schedule

Inauguration 🏛️ 20th September, 2022 @ 9:30-9:55 am IST (+5:30 GMT)

SPEAKERS

Shailesh Nayak, Director, NIAS, India



A Scientific Drilling in Koyna: An Experiment to Understand Triggered Earthquakes

🏛️ 20th September @ 10:00 am IST
19th September @ 09:30 pm PDT
20th September @ 06:30 am CEST

Abhijit Ghosh, Univ. of California, USA



Structural Complexities Control Rupture of the Himalayan Megathrust

🏛️ 21st September @ 10:00 am IST
20th September @ 09:30 pm PDT
21st September @ 06:30 am CEST

Jeanne Hardebeck, USGS, USA



What causes Aftershocks?

🏛️ 22nd September @ 10:00 am IST
22nd September @ 12:00 am EDT
21st September @ 09:30 pm PDT
22nd September @ 06:30 am CEST

Dapeng Zhao, Tohoku University, Japan



Seismic structure and dynamics of the Japan subduction zone

🏛️ 23rd September @ 10:00 am IST
23rd September @ 01:30 pm JST
22nd September @ 09:30 pm PDT
23rd September @ 06:30 am CEST

C. P. Rajendran, NIAS, Bengaluru



The Medieval Pulse of Earthquakes in the Central Himalaya and the future seismic hazard in the region

🏛️ 24th September @ 09:00 am IST

Sukanta Roy, Director, BGRL (MoES), India



Deep drilling and downhole measurements/monitoring to understand earthquake processes

🏛️ 25th September @ 10:00 am IST
24th September @ 09:30 pm PDT
25th September @ 06:30 am CEST

Margarita Segou, British Geol. Survey, UK



The physics of earthquake interactions: Recent Advances Informed by Deep-Learning Catalogs

🏛️ 26th September @ 03:00 pm IST
26th September @ 10:30 am BST

Sumer Chopra, Director, ISR-Gujarat



Seismicity in intraplate Gujarat region

🏛️ 27th September @ 10:00 am IST
26th September @ 09:30 pm PDT
27th September @ 06:30 am CEST

Sridevi Jade, Head, CSIR-4PI, India



GNSS based Geoscience Research in Indian Subcontinent

🏛️ 27th September @ 03:00 pm IST
27th September @ 02:30 am PDT
27th September @ 11:30 am CEST

Justin Rubinstein, USGS, USA



Earthquakes in the Heartland: How Energy Production Causes Earthquakes in Unexpected Places

🏛️ 28th September @ 10:00 am IST
27th September @ 09:30 pm PDT
28th September @ 06:30 am CEST

3rd International Virtual Workshop on Global Seismology & Tectonics

20-30th September 2022

Webinar Schedule

SPEAKERS

Wiwit Suryanto, UGM, Indonesia

Sagarika Mukhopadhyay, IIT-Roorkee, India



Crustal Anisotropy of Sumatera from Harmonic Decomposition of Receiver Function



29th September @ 10:00 am IST
29th September @ 11:30 am WIB



3-D Seismic Velocity Structure of the Lithosphere and its Geodynamic Implications for the Western Himalayas, Western Himalayan Syntaxis, and Pamir-Hindu Kush Region



29st September @ 03:00 pm IST
29st September @ 02:30 am PDT
29st September @ 11:30 am CEST

Julian J. Bommer, Imperial College London, UK



Earthquake Hazard and Risk Analysis for Natural and Induced Seismicity: Towards Objective Assessments in the Face of Uncertainty



30th September @ 03:00 pm IST
30th September @ 10:30 am BST



3rd International Virtual Workshop on Global Seismology & Tectonics

20-30th September 2022



Organizing Committee

Patron



G. Narahari Sastry
Director, CSIR-NEIST
Govt. of India

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United State Geological Survey
USA



Dapeng Zhao
Tohoku University
Japan



Alan L. Kafka
Boston College
USA

National Advisers



H. K. Gupta
President, Geological Society of India



V. M. Tiwari
Director, CSIR-NGRI



O. P. Mishra
Director, NCS-New Delhi



K. Sain
Director, WIHG-Dehradun

Session Chairperson



J. R. Kayal
Former Dy. DG, GSI, India

Session Co-Chairpersons



Wiwit Suryanto
Gadhja Madha University, Indonesia



D. Hazarika
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S. Gupta
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T. Singh
CSIR-CSIO



T. Goswami
Dibrugarh University



P. N. S. Roy
IIT-Kharagpur



U. J. Mahanta
Principal, J. B. College



A. K. Misra
Sikkim University



Saitluanga
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Binita Pathak
Dibrugarh University



I. Parvez
CSIR-4PI



P. Kumar
CSIR-NGRI



A. Dhawan
CSIR-ISTAD



S. Phukan
Gauhati University



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D. Saikia
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Sima Ghosh
NIT-Agartala



Bubul Bharali
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CSIR-CIMAP



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S. Ibotombi Singh
Manipur University



S. K. Paul
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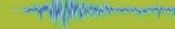
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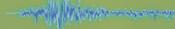
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- ★ The virtual workshop, in the form of a series of lectures, will be held only via Microsoft Teams, an internet based visual communication platform.
- ★ The participants are requested to download and install Microsoft (MS) Teams software (<https://www.microsoft.com/en-in/microsoft-365/microsoft-teams/download-app>) in their desktop or mobile devices.
- ★ The participants are expected to mute their microphones and turn off their cameras during lectures by the speakers. They can be turned on only if direct interaction during Q&A session is desired.
- ★ E-certificate shall be provided to registered participants upon request, if they have attended at least 80% of the virtual workshop.



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International Virtual Workshop on Global Seismology & Geophysics
2022

1. Abstract from the Key Speakers

CSIR – North East Institute of Science and Technology, Jorhat

A SCIENTIFIC DRILLING IN KOYNA: AN EXPERIMENT TO UNDERSTAND TRIGGERED EARTHQUAKES

Abstract

During last few decades, triggered earthquakes are receiving increasing attention from scientific community world over. Triggered earthquakes occurs when anthropogenic engineering activities bring about release of pre-existing stress of tectonic origin. Such earthquakes have significant social and economic impacts. The anthropogenic engineering activities, such as artificial reservoir impounding, large open and underground mining, fluid injection or hydro fracking, underground explosion and petroleum exploration can cause earthquakes. The reservoir-induced seismicity (RTS) has been reported from about 120 sites during last 70 years throughout the world. The Koyna earthquake occurred on the December 11, 2017, is the largest known triggered earthquake in the world. The ShivajiSagar and later the Warna reservoirs at Koyna have induced earthquakes during last 50 years, and many studies have been carried out to understand this phenomenon. However, the current models do not explain their genesis as direct observational data along the fault plane have been lacking.

The Koyna site was chosen as to carry out deep scientific drilling, 5-7 km deep, to understand RTS and model the same. One of the major requirements for modelling is availability of direct observations or measurements of various parameters to constraint the RTS model. The main objective of the study was to understand and model the genesis of the RTS. A deep drilling at appropriate locations in the Konya area was planned to make direct measurements of physical and chemical changes before, during and after earthquakes. The experimental design comprised three stages, preliminary investigations, pilot bore hole and main Borehole. The preliminary investigations and pilot boreholes provided new insight into geology and brittle formations of the area as well as seismogenic features of the area. For the first time, the entire Deccan basalt flows and its contact with the granite basement were revealed. The thickness of Deccan basalt thickness is 1251 m and has a sharp contact with the basement.

The granitoid basement is composed of granite, granite gneiss and migmatite gneiss. Low and variable strength and elastic properties of basement granitoids indicate that rock strength has been modified by the recurrent seismic activity. It also implies that rocks are not strong enough to produce large earthquakes. A recent study, based on gross strain estimates, suggested that the earthquake activity may continue in the Koyna seismic zone while the same may diminish in the Warna seismic zone. The site for main borehole of about 7 km deep will be decided after analysis of data obtained from fault zone observatory. It is expected that information about physical and chemical changes occurring during pre-, during and post- earthquakes will be able to provide sufficient to model reservoir-induced seismicity.



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WHAT CAUSES AFTERSHOCKS? A REVIEW OF STATISTICAL AND PHYSICAL MODELS

Abstract

Aftershocks can be damaging and deadly, for example more than 150 people were killed by the M7.3 aftershock of the of the 2015 Gorkha, Nepal earthquake, and more than 180 people were kill by the 2011 M6.3 Christchurch, New Zealand, earthquake that was an aftershock of the earlier Darfield earthquake. Aftershocks are also some of the most “predictable” earthquakes, in that we know that following a large mainshock there will be more earthquakes. Like mainshocks, the exact time, place, and magnitudes of individual aftershocks can’t be predicted. However, empirical models have been developed that can estimate the probability of aftershocks as a function of space, time, and magnitude. The most widely used empirical model is the Epidemic Type Aftershock Sequence (ETAS) model. Physical models for aftershock occurrence have been proposed, tested, and discussed in the literature for decades, but there is not yet a consensus physical model of aftershock triggering. Aftershocks are thought to be triggered primarily by changes in crustal stress due to the mainshock. The most commonly used physical model is static Coulomb stress change. A positive Coulomb stress change is thought to move faults towards failure, while a negative Coulomb stress change inhibits failure. Dynamic stresses from passing seismic waves have been shown to trigger distant earthquakes, and there is evidence that dynamic stresses are important in the triggering of near-field aftershocks as well. Additional processes initiated by the mainshock, such as afterslip, viscoelastic stress transfer, and pore pressure evolution, may also alter the stress field and trigger aftershocks. It is quite difficult to monitor stress changes at seismogenic depths in order to track when and where aftershocks might occur, but some methods have been proposed to do so, particularly using the b-value (essentially the relative rate of large and small earthquakes). Physical properties of the crust may also influence aftershock occurrence, for example the temperature, the rock type, or the presence of pre-existing faults. With the further development of physical models of aftershock occurrence, we will improve our ability to forecast these potentially damaging and deadly earthquakes.



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SEISMIC STRUCTURE AND DYNAMICS OF THE JAPAN SUBDUCTION ZONE

Abstract

We investigate the 3-D P and S wave velocity structure of the East Japan arc using a large number of high-quality arrival-time data of local earthquakes recorded by a permanent seafloor seismic network (S-net) and the land-based Kiban seismic network (Zhao *et al.*, 2022). Geometries of the subducting slab boundary and the Conrad and Moho discontinuities under the forearc are refined by referring to results of previous studies including active-source seismic soundings and seismicity located by the S-net. The obtained P and S wave velocity images are quite similar to each other, suggesting that they reflect robust features of the 3-D seismic structure. The subducting Pacific slab exhibits high velocities, whereas significant low-velocity (low-V) anomalies are revealed in the overlying Okhotsk plate beneath the forearc, which may reflect accretionary materials containing abundant fluids. The subducting oceanic crust atop the Pacific slab is revealed clearly as a thin low-V layer extending from the trench axis down to ~100 km depth under the volcanic front. Our results of earthquake relocation using the 3-D velocity model indicate that the double seismic zone in the subducting Pacific slab occurs from the trench axis down to ~180 km depth. The occurrence and focal mechanisms of the double seismic zone are caused by slab deformation during its subduction, such as slab bending or unbending, as well as other processes including hydration, dehydration, compositional variations, and phase changes in the subducting slab.

The water cycle in subduction zones is closely related to the generation of large earthquakes and arc magmas. Outer-rise hydrated faults subducting with the oceanic lithosphere are important for the water cycle. However, geophysical evidence for the intraslab hydrated faults beneath forearc is scarce. We determined high-resolution P-wave anisotropic tomography of the Tohoku forearc derived from arrival-time data recorded at both onshore and offshore seismic stations (Wang & Zhao, 2021; Wang *et al.*, 2022). Trench-parallel intraslab fast velocity planes of anisotropy are revealed that intersect the slab upper surface at high angles (~45°–90°), reflecting aligned hydrated faults in the slab. Ruptures of the hydrated faults may cause large intraslab earthquakes. The hydrated fault associated water entering a large near-trench asperity in the megathrust zone could have triggered the great 2011 Tohoku-oki earthquake (Mw 9.0).

High-resolution seismic velocity and attenuation tomography has clearly imaged the subducting Pacific and Philippine Sea (PHS) slabs beneath western Japan (Zhao *et al.*, 2021). Low-V and high-attenuation (low-Q) anomalies are revealed in the crust and mantle wedge beneath the volcanic front and back-arc areas, which reflect arc magmas produced by corner flow in the mantle wedge and slab dehydration. Low-V and low-Q zones in the forearc mantle wedge reflect mantle serpentinization due to abundant fluids from the young and warm PHS slab. Low-V anomalies appear below the PHS slab, which reflect upwelling flow in the big mantle wedge above the Pacific slab and may heat the PHS slab from below, causing aseismic PHS slab at depths > 100 km under



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Shikoku and Chugoku. Results of anisotropic tomography show that the Pacific and PHS slabs exhibit mainly trench-parallel fast-velocity directions (FVDs), which may reflect lattice-preferred orientation of anisotropic minerals as well as shape-preferred orientation of steep normal faults produced at the outer-rise area near the trench axis (Zhao, 2021). Trench-normal FVDs are generally revealed in the back-arc mantle wedge and slab asthenosphere, reflecting mantle flows entrained by the plate subductions. Large megathrust earthquakes nucleated in or around patches with high-V, high-Q and low Poisson's ratio along the slab interface, which may represent strongly coupled areas in the megathrust zone, suggesting that structural heterogeneities in the megathrust zone, such as the subducting seafloor topography and compositional variations, control the nucleation of megathrust earthquakes. The PHS slab has subducted aseismically down to ~450 km depth. The lithospheric age of the PHS slab ranges from 15 to 43 Myr in western Japan. The Beppu-Shimabara graben was produced by joint effects of northward extension of the opening Okinawa Trough, westward extension of the Median Tectonic Line, and hot and wet upwelling flow in the mantle wedge. The generation of large crustal earthquakes is affected by structural heterogeneities in the crust and upper mantle, in particular, arc magma and fluids.

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THE MEDIEVAL PULSE OF EARTHQUAKES IN THE CENTRAL HIMALAYA AND THE FUTURE SEISMIC HAZARD IN THE REGION

Abstract

The Himalaya, which occupies the ~2500 km-long plate boundary between Indian and Eurasian plates, has experienced three large or great earthquakes during the last century. Temporal and spatial distribution of earthquakes along this plate boundary, however, suggests existence of unbroken segments, the most prominent being the ~600-km-long “Central Gap” between the 1905 Kangra ($M_w \leq 8.0$) and the 1934 Bihar ($M_w 8.1$) earthquakes. The database on historical, geological proxies and direct observations on faulting along the MFT help arriving at a reasonable conclusion on the last great medieval earthquake that impacted the central Himalaya. Mainly four historical candidates (1100, 1255, 1344, and 1505) have to be considered here to test how the database agrees with any one of them. The structural and age constraints obtained from various trench sites across the MFT along a 600-km-long stretch from Bhatpur in the west to MohanaKhola CE by and large suggest the occurrence of a great earthquake between 14th and 15th centuries. This event in all probability correlates with the historical candidate of 1344 CE. The episodic valley infill deposits identified near Pokhara, ~150 km west of Kathmandu has been attributed not only to the earthquakes of 1100, 1255 CE, but also to the one occurred in 1344 CE

The Tibetan archives contain information on a damaging earthquake that occurred in June, 1505. Although the historical archives from Kathmandu (Nepal) refer to two damaging previous earthquakes (1255 and 1344 CE), they are curiously silent on the earthquake of 1505 CE. The Indian sources are also equally unproductive in terms of generating any credible references for this 16th earthquake or any associated damage, considering its projected size. The available information from Delhi (northern India), however, implies a sustained period of reconstruction centered on monuments including the 800-year old QutbMinar during the mid-14th century. The widespread contemporary damage reflected on the 12-14th century monuments (temples) in the Indian central Himalaya suggests a regionally impacted earthquake in the medieval times.

Previous paleoseismic studies in the central Himalaya of India suggest a great earthquake between 1200 and 1700 CE, and studies in the adjoining Nepal have suggested evidence for paleo-earthquakes around 1100 and 1255 CE. However, the seismicity rate of the Himalaya is considered quite low for its estimated convergence rate of 20 ± 3 mm/year, and it is likely that either there are missing earthquakes or they might have occurred in quick succession, expending the accumulated strain. Here we describe new evidence from a trench excavated in the central seismic gap of Himalaya, for two potentially great earthquakes that occurred in close succession, during AD 7-12th and 12-13th century. Our interpretation clears the ambiguities on previously obtained time constraints on the last great event in the central Himalaya. Our results suggest a great earthquake in the mid-thirteenth century, and if it overlaps with the historically known AD 1255 Nepal earthquake, it would represent the



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greatest surface rupture event in the Himalaya ($M \geq 8.5$). The earlier event identified in our trench may correspond to the AD 1100 earthquake reported from central Nepal. Alternatively, if these events have occurred independently, it would suggest that the two adjoining segments experienced an unusual pulse of energy release during a short interval. If indeed the earthquake pattern is defined by such spatial and temporal clustering of great earthquakes, it challenges the conventional models of earthquake recurrence that assumes quasi-periodicity. A re-evaluation of the faulting history of a central Himalayan site attempted here points to a relatively long-lived earthquake dormancy (~700 years), which represents the interseismic interval, and if the past is the key, an active future phase of great earthquakes in the central Himalaya is to be expected.

The present study underlines the fact that the frontal thrust in central Himalaya (covering the Indian and eastern Nepal parts) has remained seismically quiet, since the medieval pulse of great earthquakes, and a seismic gap in temporal as well as spatial sense is real. And, if the past is the key, the long elapsed time (600-700 years) implying enormous stacking up of strain in the region portends at least one $M \geq 8.5$ earthquake in one of these overlapping segments of the central Himalaya, anytime in future. Considering this potentially high seismic risk, this will be particularly catastrophic for a region marked by ever-growing population and unhindered expansion of built-environment, to be contrasted with poor preparedness to meet this contingency.

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DEEP DRILLING AND DOWNHOLE MEASUREMENTS / MONITORING TO UNDERSTAND EARTHQUAKE PROCESSES: A STUDY FROM THE KOYNA SEISMOGENIC ZONE, INDIA

Abstract

Scientific drilling investigations in active fault zones can contribute to better understanding of earthquake processes in several ways, primarily by providing constraints on the deep subsurface conditions from geophysical and seismological data, and by providing geological samples from the seismogenic depths to study deformation behaviour, rock strength, seismic velocity, permeability and frictional properties. These parameters can be constrained either from measurements / monitoring in the “near field” of earthquakes (e.g., physical and mechanical properties, temperature, stress regime, fracture patterns) or by laboratory studies on geological samples from deep fault zones (e.g., structure, deformation behaviour, permeability, frictional strength). Therefore, for a complete understanding of earthquake nucleation, constraining these subsurface parameters is essential, in addition to analyses of seismological data collected at the surface. Scientific deep drilling was carried out to depth of 3 km in the Koyna region in western India as part of a major programme to investigate the recurrent reservoir triggered earthquakes over the past 55 years. Downhole geophysical data and high resolution images of the borehole were acquired. Analyses of the data provided valuable direct information on in-situ physical and mechanical properties of rocks at seismogenic depths, sub-surface fault / fracture zones and their properties, subsurface stress and temperature regime, and orientation of subsurface fault(s) / fractures and their disposition w.r.t. stress orientation, and the nature of faulting in the region. In Koyna, favourable condition exists for earthquakes to occur due to presence of optimally oriented, critically stressed and hydraulically conductive fractures. Small changes in fluid pressure and/or frictional strength could provide the necessary trigger for failure. The study further highlights the need for deep borehole monitoring at hypocentral depths and laboratory experimentation to constrain RTS mechanisms in the region.



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THE PHYSICS OF EARTHQUAKE INTERACTIONS: RECENT ADVANCES INFORMED BY DEEP-LEARNING CATALOGS

Abstract

This talk discusses an ongoing project aiming to improve our understanding of triggering mechanisms within earthquake sequences by quantitative testing of static stress triggering hypothesis and developing and testing physics-based forecast models using very-high resolution earthquake catalogs. The last 30 years stress changes, often coupled with continuum mechanics, is our vehicle for describing the complex physical laws governing earthquake cascades with several retrospective experiments around the world focusing on their continuous advancement. In recent projects, we are developing models tracking the space-time evolution of the Central Apennines 2016-2017 (CA16) sequence based on real-time, high-resolution and deep learning catalogs. The results suggest that a combination of critical elements, such as source and fault characterization together with optimized parametrization and representation of fault heterogeneity, leads to improved model performance for physics-based models. The small-scale heterogeneity around geological scale faults known from past ruptures allows us to go beyond standard simplified parallel receiver fault implementations. However, as earthquake catalogs improve, we now observe some localized inter-sequence aftershock variability in physics-based performance suggesting that real-time receiver plane updates are necessary to sustain a good model performance within the sequence. The new CA16 forecasts are motivated by the 2010 El Mayor-Cucapah sequence findings about the importance of the pre-earthquake stress field, and also inspired the 2019 Ridgecrest forecast model development. The continuous testing of hypothesis-driven forecasts based on high-quality earthquake catalogs might offer insights not only to expected aftershock population patterns but also to the preparation of large earthquakes. We are now entering an era where data exploration would become increasingly important for revealing the unknown unknowns that possible have a transformative power for earthquake forecasting.



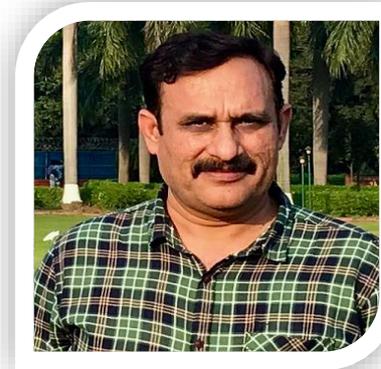
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SEISMICITY IN INTRAPLATE GUJARAT REGION

Abstract

It is found that intraplate earthquakes constitute only 0.5% of the total global earthquakes. Although, they are quite rare, these are destructive as these regions are highly populated. The Gujarat region located in the westernmost part of India is an intraplate region which is seismically active. The region has experienced three damaging earthquakes, 1819 (Mw7.8), 1956 (Mw6.0) and 2001 (Mw7.6), in last 200 years. Institute of Seismological Research (ISR), established after 2001 Bhuj earthquake, is instrumental in routinely monitoring earthquakes through its seismological network and has provided wealth of data in last 15 years. The data provided wealth of information on the seismicity of this intraplate region. The region comprises of three distinct regions: Kachchh, Saurashtra and Mainland. The Kachchh comprises of a failed rift, Saurashtra is a horst and mainland Gujarat comprises of two rifts, namely, Cambay and Narmada. Out of these three, Kachchh is seismically most active where large active faults are present and capable of generating large earthquakes. It is found that in the Kachchh region, most of the earthquakes occurred at middle to lower crustal depths (10–35 km), while in Saurashtra, swarm type activity is dominant and earthquakes are in the range of 1-15 km depth. The earthquakes in the mainland region, are occurring at depths, mostly in the range 5-20 km. It is found that the earthquake source areas are fluid-filled rock matrices that are creating additional stresses in the regions causing earthquakes.



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GNSS BASED GEOSCIENCE RESEARCH IN INDIAN SUBCONTINENT

Abstract

Geodetic grade dual frequency Global Navigation Satellite System (GNSS) measurements provide position on the surface of earth to mm precision which is used for estimating the crustal rates at plate, regional and local scale over Indian subcontinent. Continuous and episodic GNSS observation network (Figure 1) is used to study the inter-seismic, co-seismic and post-seismic deformation in Indian subcontinent. Three decades of GNSS data is used to determine the precise International Terrestrial Reference Frame (ITRF) surface velocities at the Indian tectonic plate boundaries and plate interiors. These velocities are inverted to estimate the euler pole of rotation of Indian tectonic plate which defines the Indian Reference Frame. India fixed velocities are used to determine the geodetic strain rates and to model the slip on Main Himalayan Thrust along the 2500 km long Himalayan Arc. Comprehensive analysis of geodetic and seismic strain rates is used to estimate the probable magnitude and recurrence interval of earthquakes at Indian plate interiors and boundaries. For a specific earthquake, extent of rupture and post seismic deformation are modelled by inverting co & post seismic velocities.

GNSS measurements are also used for real time monitoring of an active landslide in Jalgar village, Chamoli district, Uttarakhand along with collocated geotechnical Instrumentation. Results give strain rates across the cross-sections oblique to the motion of the landslide which are integrated with geotechnical investigation for reliable landslide hazard estimation. In addition to surface motion, GNSS observations also give the delay in the transmission of signals through ionosphere and troposphere which in turn are used to estimate Precipitable Water Vapor (PWV) column in atmosphere and Total Electron Content (TEC) in ionosphere. Variability of PWV and TEC over the Indian subcontinent for 10 to 20 year period give significant insights in to the extreme rainfall events and seismo-ionosphere coupling. GNSS derived crustal rates, PWV and TEC can be used for natural hazard assessment such as earthquakes, landslides, glaciers and extreme events.



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EARTHQUAKES IN THE HEARTLAND: HOW ENERGY PRODUCTION CAUSES EARTHQUAKES IN UNEXPECTED PLACES

Abstract

The central United States is experiencing an unprecedented surge in earthquakes that began in 2001, rising from an average of 21 magnitude 3 and larger quakes and peaking at over 1000 in 2015 alone. This increased earthquake activity is found in just a few concentrated regions around the country, all areas of increased oil and gas production. The largest increase in seismicity has occurred in Oklahoma, where earthquake rates were so elevated that they exceeded the earthquake rate of California each year from 2014 through 2018. Most of this seismicity has been induced by a process known as “wastewater disposal”, which is a process where waste fluids from the oil production process is injected deep underground. Contrary to public perception, only a small percentage of the seismicity increase in the United States is induced by hydraulic fracturing. While hydraulic fracturing has not been responsible for many earthquakes in the United States, it has been connected to many earthquakes in both Canada and China, including multiple M5+ earthquakes in China that resulted in fatalities. In this presentation, I will cover the evolution of our knowledge of induced seismicity going back to the first induced earthquakes in the 1890s extending to the present. I will explore how these fluid injection processes cause earthquakes and what conditions make fluid injection operations more likely to induce earthquakes. We will also cover recent advances in our understanding of induced earthquakes that include statistical and mechanical methods to forecast induced earthquake rates. These earthquake rate forecasts are also now being employed to estimate the earthquake hazard from induced seismicity.



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CRUSTAL ANISOTROPY OF SUMATERA FROM HARMONIC DECOMPOSITION OF RECEIVER FUNCTION

Abstract

Past and present tectonic processes control the tectonic complexity of Sumatera. A Series of tectonic episodes deformed the crust and formed geological structures, which can be analysed using seismic anisotropy. Some studies on the seismic anisotropy of Sumatera, especially the deformation from the tectonic process, only concentrated within the crust. The analysis focused on this zone, and differentiation within its two layers is not constrained well. Moreover, this zone is prone to deformation in the form of fault slip that can produce a significant earthquake. Thus, the information regarding the anisotropy characteristics of the crust of Sumatra becomes essential.

The harmonic decomposition of the receiver function is a suitable method to analyses the anisotropy of both shallow and lower crust because of its sensitivity to depth. The anisotropic trend assumes that the receiver function was decomposed by back azimuth.

Harmonic decomposition is performed using 111 stations of permanent and temporary networks: GE, ZB, and 7A. The analysis will be carried out in shallow (0-15 km) and deep crusts (15-30 km) to accommodate its different rheology. The trend of anisotropy obtained from this method will be interpreted with past-present deformation and their relation. The result will provide an image of the crust's deformation processes, which is valuable in geodynamics and hazard analysis.



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3-D SEISMIC VELOCITY STRUCTURE OF THE LITHOSPHERE AND ITS GEODYNAMIC IMPLICATIONS FOR THE WESTERN HIMALAYAS, WESTERN HIMALAYAN SYNTAXIS AND PAMIR-HINDU KUSH REGION

Abstract

Travel time tomography was carried out for the NW Himalayas and Pamir-Hindu Kush region to evolve a comprehensive geodynamic model of this tectonically active and complicated area. The tomographic image is well resolved up to ~150 km depth in the Western Himalayas and up to ~300 km depth in the Pamir-Hindu Kush region. The top low-velocity anomaly imaged up to ~80 km depth correlates well with the thicker crust with deeper low-density roots under the high mountains in the northwest Himalayas and the Pamir-Hindu Kush region. The thickness of the crust varies all along and across the tectonic trend of the northwest Himalayas which we interpret as due to anticlockwise rotations of the Indian plate and thrusting, shortening, buckling, and exhumation during the Indo-Asia collision. The Indian lithospheric slab is imaged as a gently underthrusting high-velocity anomaly under the northwest Himalayas and subducted Indian lithospheric slab which follows the trend of intermediate depth seismicity under the Pamir-Hindu Kush region. Beneath the Pamir-Tien Shan, the dipping high-velocity anomaly which follows the trend of intermediate depth seismicity represents the remnant of the southward subducted Asian slab. In the southwest of Hindu Kush, the Indian lithospheric slab rolls over, overturns at a depth of ~250 km, and dips southward. The Delhi-Haridwar ridge, imaged as a high-velocity structure, is butting against the northwest Himalayas, leading to ramming and locally buckling of the crust therein.



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Research Interest	Seismic Tomography, Seismology, Attenuation and Anisotropy
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EARTHQUAKE HAZARD AND RISK ANALYSIS FOR NATURAL AND INDUCED SEISMICITY: TOWARDS OBJECTIVE ASSESSMENTS IN THE FACE OF UNCERTAINTY

Abstract

The fundamental objective of earthquake engineering is to protect lives and livelihoods through the reduction of seismic risk. Directly or indirectly, this generally requires quantification of the risk, for which quantification of the seismic hazard is required as a basic input. Over the last several decades, the practice of seismic hazard analysis has evolved enormously, firstly with the introduction of a rational framework for handling the apparent randomness in earthquake processes, which also enabled risk assessments to consider both the severity and likelihood of earthquake effects. The next major evolutionary step was the identification of epistemic uncertainties related to incomplete knowledge, and the formulation of frameworks for both their quantification and their incorporation into hazard assessments. Despite these advances in the practice of seismic hazard analysis, it is not uncommon for the acceptance of seismic hazard estimates to be hindered by invalid comparisons, resistance to new information that challenges prevailing views, and attachment to previous estimates of the hazard. The challenge of achieving impartial acceptance of seismic hazard and risk estimates becomes even more acute in the case of earthquakes attributed to human activities. A more rational evaluation of seismic hazard and risk due to induced earthquakes may be facilitated by adopting, with appropriate adaptations, the advances in risk quantification and risk mitigation developed for natural seismicity. While such practices may provide an impartial starting point for decision making regarding risk mitigation measures, the most promising avenue to achieve broad societal acceptance of the risks associated with induced earthquakes is through effective regulation, which needs to be transparent, independent, and informed by risk considerations based on both sound seismological science and reliable earthquake engineering.



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2. *e-Abstract from the Participants*





TIME AND MAGNITUDE RELATIONSHIPS BETWEEN EARTHQUAKE FORESHOCKS AND MAINSHOCKS

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Abstract

Foreshocks precede the mainshock of an earthquake. But all mainshocks don't have foreshocks but most do. So foreshocks can be used to forecast the probability of a major earthquake. Therefore, time and magnitude relationships between known mainshocks and foreshocks are useful to forecast future mainshocks. Through such forecasting and awareness, the risk to the community can be reduced. During this research, the relationship between foreshocks and a mainshock was investigated to be able to forecast the mainshock. Investigating whether foreshocks preceded micro-earthquakes in Sri Lanka and whether those were of tectonic or non-tectonic origin are the other specific objectives of this study. The foreshock-mainshock relationship was investigated in the seismic tectonic zone of Japan which is a highly active seismic zone. The earthquakes that occurred during 2017-2022 with the 3-7 magnitude range were considered. Foreshocks were identified as the events where the magnitude was smaller than the main event and which occurred within two months at a 50 km radius area from the mainshock. SEISAN and GeoDAS software were used to analyze the data. According to the Japanese event data, two different kinds of foreshocks as within 24 hours of mainshock and more than 24 hours with the mainshock were identified. Both magnitude of foreshocks and magnitude difference between foreshocks and mainshocks have threshold values with the mainshock magnitude values. Foreshocks number per day with time in days before mainshock for different magnitude ranges is having a $y = -mx + c$ type of relationships with a possible variations in values from +2 to -2 for m and c values. The b value from Gutenberg-Richter relationship is nearly equal to 1 for the tectonic earthquakes. Most of the foreshocks and mainshocks of studied Japanese events appear to be related with reverse faulting and there was no requirement for all of the foreshocks of events to have the same focal mechanism but the dependence on focal mechanism is not clear. According to the available data, micro-earthquakes in Digana area of Sri Lanka were also preceded by foreshocks.

Keywords: *Japan, Sri Lanka, Microearthquake*



ESTIMATION OF SOIL OVERBURDEN THICKNESS/DEPTH OF ROCK STRATA USING GEO-PHYSICAL SURVEY AT GANGTOK

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Abstract

Estimation of soil overburden and depth of competent strata for construction of infrastructures in hilly terrain is a challenging job for engineers. Modern technologies like Electrical Resistivity Survey (ERS) techniques with site geological mapping have been carried out at the ridge area near Palace, Gangtok. Two independent 2D-electrical resistivity surveys profile sections using hybrid Schlumberger-Wenner method were conducted along the ridge line trending in the North-South direction. The ERS profile sections were taken on both the slopes of the ridge along its eastern and western flanks. With the collective information from field and geo-technical data, a comparatively stable slope has been identified with respect to geological conditions in the present work, which focuses on the vulnerable slope failure with respect to slope direction, local geological condition, depth of competent strata, thickness of soil overburden, water saturation zones and resistivity of the materials. Diamond core drilling of 15meters each was carried out at both the flanks of the slope to understand the sub-surface strata and correlate it with resistivity data generated by ERS survey. The result indicates that Sandy/silty soil with flakes of mica having resistivity of 107 ohm-m and weathered mica schist having resistivity more than 300 ohm-m in the present study area. Geological mapping in 1:3000 scale was carried in the area demarcation with various litho-units and rock type. The area is characterized by medium grade metamorphic rock sequence represented in the area by mica schist having dip of foliations towards NE direction and three sets of joint planes. The geometry of the rock orientation and slope direction plays a vital role for determining the overall stability condition of the area. The present study will provide technical input for structural engineers to design the structures in such geological conditions. Further, the thickness of overburden estimated from ERS has been validated by drilling data.

Keywords: *Electrical resistivity technique, Soil overburden, Geological mapping, Slope stability*



ANOMALOUS TEC HEAT MAP AND CONTOUR IMAGES ALONG WITH SOLAR FLUX AND MAGNETIC FIELD DISTURBANCES REPRESENTATION OF 2021 EARTHQUAKES

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Abstract

The present paper examines GPS-based TEC for earthquakes of 2021 ($M \geq 6$). Each earthquake is displayed with TEC heat map for 60 days (30 days before and 30 days after). On the other hand, contour mapping is done for individual days during which TEC showed abnormal variation. The earthquakes are from all around the world, (1) the Kermadec Islands, New Zealand ($29^{\circ}43'S$, $177^{\circ}17'W$) on 04 March 2021 ($M = 8.1$), (2) Gisborne, New Zealand ($37^{\circ}29'S$, $179^{\circ}27'E$) on 04 March 2021 ($M = 7.3$), and (3) Chickaloon, Alaska ($62^{\circ}26'N$, $148^{\circ}15'W$) on 31 May 2021 ($M = 6.1$), (4) Pocito, Argentina ($31^{\circ}50'S$, $68^{\circ}48'W$) on 19 January 2021 ($M = 6.4$), (5) Japan ($38^{\circ}12'N$, $141^{\circ}36'E$) on 01 May 2021 ($M = 6.0$), (6) Namie, Japan ($37^{\circ}43'35''N$, $141^{\circ}46'30''E$) on 13 February 2021 ($M = 7.1$), (7) Ishinomaki, Japan ($38^{\circ}27'5''N$, $141^{\circ}38'52''E$) on 20 March 2021 ($M = 7.0$), (8) Bougie, Algeria ($36^{\circ}55'14''N$, $5^{\circ}12'5''E$) on 18 March 2021 ($M = 6.0$), (9) Lorengau, Papua New Guinea ($3^{\circ}13'53''S$, $146^{\circ}47'59''E$) on 21 July 2021 ($M = 6.0$). We calculated the upper range of TEC by using the interquartile range after dividing median TEC by the interquartile range to identify abnormal values of TEC. There is a better correlation between the location of TEC in the ionosphere and that of the earth in heat maps and contour maps. Solar radiation effects on magnetic field and TEC were also shown graphically in F10.7, Dst, Kp, and Ap (Geomagnetic activity indices). In the period leading up to and following an earthquake, abnormalities in TEC are observed.

Keywords: Earthquake, Ionosphere, TEC, F10.7, Dst, Kp, Ap (Daily Geomagnetic activity parameter)



ANOMALOUS VARIATION IN GPS TEC, LAND AND OCEAN PARAMETERS PRIOR TO 3 EARTHQUAKES

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Abstract

The present study reports the analysis of GPS TEC prior to 3 earthquakes ($M > 6.0$). The earthquakes are: (1) Japan ($37^{\circ} 43'35.4''$ N, $141^{\circ} 46'30.4''$ E) on 13 February 2021 ($M = 7.1$), (2) Philippines ($4^{\circ} 07'55.9''$ N, $124^{\circ} 38'39.5''$ E) on 10 April 2021 ($M = 6.1$), and (3) Taiwan ($23^{\circ} 23'02.0''$ N, $121^{\circ} 36'42.5''$ E) on 22 March 2022 ($M = 6.7$). In an effort to search for a precursory signature we analysed the land and ocean parameters prior to the earthquakes, namely SLHF (Land) and SST (Ocean). The GPS TEC data indicate an anomalous behaviour from 2016-2022 earthquakes. The main purpose of this study was to explore and demonstrate the possibility of any changes in TEC, SST, CLW, Water vapor and SLHF before, during and after the earthquakes which occurred near or beneath an ocean. This study may lead to better understanding of response of land, ocean, and ionosphere parameters prior to seismic activities.

Keywords: *TEC, Sea surface temperature, Cloud liquid water, Water vapor, Surface latent heat flux,*



EARTHQUAKE ANALYSIS BY ANOMALOUS VARIATION IN GPS BASED TEC DURING 2022

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Abstract

The present paper examines GPS-based TEC for earthquakes of 2022 ($M \geq 6$). Each earthquake is displayed with TEC heat map for 60 days (30 days before and 30 days after). On the other hand, contour mapping is done for individual days during which TEC showed abnormal variation. The earthquakes are from all around the world, (1) Cyprus, Israel ($35^{\circ}13'N$, $31^{\circ}56'E$) on 11 January 2022 ($M = 6.6$), (2) Labuan, Indonesia ($6^{\circ}51'S$, $105^{\circ}17'E$) on 14 January 2022 ($M = 6.6$), and (3) Saiki, Japan ($32^{\circ}43'N$, $132^{\circ}02'E$) on 21 January 2022 ($M = 6.3$), (4) Barranca, Peru ($4^{\circ}27'S$, $76^{\circ}55'W$) on 03 February 2022 ($M = 6.5$), (5) Cabra, Philippines ($14^{\circ}05'N$, $119^{\circ}22'E$) on 13 March 2022 ($M = 6.4$), (6) Namie, Japan ($37^{\circ}42'N$, $141^{\circ}34'E$) on 16 March 2022 ($M = 7.3$), (7) Hualien City, Taiwan ($23^{\circ}23'N$, $121^{\circ}36'E$) on 22 March 2022 ($M = 6.7$), (8) Masachapa, Nicaragua ($11^{\circ}33'N$, $86^{\circ}57'W$) on 21 April 2022 ($M = 6.6$), (9) Yonakuni, Japan ($24^{\circ}02'N$, $122^{\circ}29'E$) on 09 May 2022 ($M = 6.2$). We calculated the upper range of TEC by using the interquartile range after dividing median TEC by the interquartile range to identify abnormal values of TEC. There is a better correlation between the location of TEC in the ionosphere and that of the earth in heat maps and contour maps. Solar radiation effects on magnetic field and TEC were also shown graphically in F10.7, Dst, Kp, and Ap (Geomagnetic activity indices). In the period leading up to and following an earthquake, abnormalities in TEC are observed.

Keywords: Earthquake, Ionosphere, TEC (Total Electron Content), F10.7 (Solar Flux), Dst, Kp, Ap



MONITORING CHANGE IN RIVER CHANNEL DYNAMICS OF BEKI RIVER NEAR MANAS NATIONAL PARK AND PROBABLE IMPACT OF KURICHHU HYDROPOWER PROJECT: A REMOTE SENSING APPROACH

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Abstract

The Beki River Basin's channel erosion, accretion, channel dynamics, and unaltered sites have all been identified using Remote Sensing, Geographic Information System tools and techniques and satellite imagery. In North-Eastern India, the Beki River cuts through the Himalayan foothills between southern Bhutan and India. The main objectives of the study is to evaluate the change in channel dynamics and probable impact of Kurichhu Hydropower Project constructed in Kurichhu in eastern Bhutan. By comparing successive shifts in the position of the channel and sand bars in the years 1990, 2000, 2010 and 2020, geomorphological changes were analysed. GIS technologies were used to depict and quantify the reach-wise spatial and temporal morphological changes. Also shown were meandering and switching off or leaving the main active channel. It is found that Beki River in the Himalayan foothill near Bhutan-India Boundary bifurcated into two channel and again it joins near Beki Road Bridge. Before the year 2000 which is pre-construction period of Hydropower Project, the westerly channel was the main channel, but after the year 2006 which is post-construction period, gradually the easterly channel activated and flows as main water carrying channel. On the other hand channel width and area of sand bars in the westerly river channel decreases drastically, which suggest that, this channel losses its water carrying capacity and will completely be abandoned in future which could be related to the construction of concern Kurichhu Hydropower Project

Keywords: *Geomorphology, Hydropower Project, Remote Sensing, Beki River*



EULER POLE PARAMETERS ESTIMATION OF JALISCO BLOCK, MEXICO USING GPS OBSERVATIONS

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Abstract

The JaliscoBlock lies in western Mexico, a geodynamic, seismic, and volcanically active zone. Global models of tectonic plate's movements are used to characterize the displacements of the Earth's lithosphere. Still, they do not describe the dynamics from a regional or local perspective of the discrete blocks in the plates. In the present study, the GPS velocity solution calculated by the Nevada Geodetic Laboratory was used to calculate current velocity through the main tectonic characteristics of the area. A recent dynamic model of Jalisco Block was obtained. It was demonstrated that it is possible to reliably model the rigid motion of the Jalisco Block using a fixed tectonic plate as a reference frame. From the velocity vectors, the parameters of the Euler's Pole were estimated at latitude 20.88° N and longitude -107.91°W. The current angular velocity was estimated to be 1.07527°/Myr ± 0.28232, representing the most recent model of the Jalisco Block

Keywords: Euler Pole, Jalisco Block, cGPS stations, Reference Frame



INFLUENCE OF CRUSTAL THICKNESS VARIATIONS ON SEISMIC OBSERVATIONS (A CASE STUDY FROM NORTH AMERICA)

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Abstract

The four basic elements of the Earth's structure are the crust, mantle, outer core and inner core. The crust is the Earth's thinnest outer layer and it is divided into continental crust and oceanic crust. The oceanic crust is only about 6 km thick, compared to the average thickness of the continental crust of 30 to 70 km. At convergent plate boundaries, where tectonic plates collide, the process of mountain-building, drives the thickness of continental crust up. Therefore, the thickest portions of continental crust can be found underneath the world's tallest mountain ranges. Seismic body waves and surface waves have been widely used to investigate the structure of the Earth's crust. In theory, body wave pulses do not change no matter how far they travel but changes are most likely to occur in surface waves. This study looked into the influence of crustal thickness on seismic waves by selecting areas with varying crustal thickness. The stations were chosen from both low and high elevation regions based on the isostatic principle that high crustal thickness can be found beneath mountain ranges, while low crustal thickness can be found under flat terrain. Other factors influencing the observations such as direction of wave propagation, distortion by distance and first motion of waves were considered. Four seismic networks were used to download seismic data for events from the North American west coast region that align with the selected stations. Downloaded data were examined using the SEISAN 10.5 software and waveform amplitudes were noted. In few instances, the high elevation station waveform displayed a slight amplitude rise. Additionally, in certain instances, the waveforms from all elevation stations—high, middle, and low showed the same wave pattern. Based on the findings of the study, significant variance in the waveform amplitude was not clearly observed. Thus, the research is extended to investigate the impact of focal mechanisms of the earthquakes on seismic observations.

Keywords: *Surface waves, Waveforms, Continental crust, Seismic*



ANALYSIS OF EARTHQUAKE POTENTIAL RISK USING GEOSTAT V2.0 SOFTWARE AND SHOCK LEVEL SCENARIOS IN SOUTH SULAWESI

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Abstract

In South Sulawesi Province, there is an active Walanae Fault causing this area to frequently experience earthquakes. This study aims to determine the level of seismicity of the earthquake in order to obtain the potential for earthquakes in the future. The estimation of the potential for earthquakes is then made a scenario model to determine the estimated level of shocks as an effort to mitigate earthquake disasters in the region. The method used in this study is the Gutenberg Richter Method through the statistical likelihood approach. This study uses earthquake data in the South Sulawesi region in 1972 - 2022. The research location is located at the coordinates of 3.5° – 5.5° South Latitude and 119.5° – 120.5° East Longitude and divided into two segments, namely the northern segment at

the coordinates of 3.5° – 4.5° South Latitude and 119,5° – 120,5° East Longitude then the southern segment with coordinates of 4.5°– 5.5° South Latitude and 119,5° – 120.5° East Longitude. This study uses earthquake parameters with a magnitude > 1 and a depth < 50 km. The results of the analysis show that the potential for earthquakes in the next 10 years with a magnitude of M = 7 in the northern segment is estimated at 98.81% with an estimated shock level of VI - VII MMI around the cities of Pare - Pare, Barru, Pinrang and Soppeng then IV - V MMI in the cities of Bulukumba, Selayar, Makassar and Gowa. In the southern segment, the potential for earthquakes in the next 10 years with a magnitude of M = 7 is estimated at 32.89% with an estimated VI - VII MMI shock level in the cities of Bulukumba, Selayar, Makassar and Gowa then III - IV MMI around the cities of Pare - Pare, Barru, Pinrang and Soppeng. Thus it can be seen that the province of South Sulawesi has a potential threat of earthquakes so that mitigation efforts need to be made to be more prepared and alert in dealing with these threats.

Keywords: *Gutenberg Richter, Likelihood Method, Seismicity, Shakemap and MMI Scale*



ANALYSIS FORECAST OF AFTERSHOCKS EARTHQUAKE DECAY IN THE FLORES SEA DECEMBER 14, 2021 USING GEOSTAT V2.0 SOFTWARE

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Abstract

There has been an earthquake in East Nusa Tenggara with a magnitude of M7.5 on December 14, 2021. This earthquake occurred at 03:20:23 Universal Time Coordinat (UTC) which is located at coordinates 7.60° South Latitude and 122.23° East Longitude with a depth of 10 km. The earthquake triggered a series of aftershocks. This study aims to estimate the estimated ending of the aftershocks using GEOSTAT software version 2.0, which includes several methods such as the Mogi-I, Mogi-II, Omori and Utsu methods. This study uses BMKG data within 7 days of the Mainshock earthquake. The estimation results of the Mogi-I method show that aftershocks are predicted to end on the 1197th day ($r=0.91392$). Then the estimated calculation of the Mogi-II method shows that aftershocks are predicted to end on the 22nd day ($r=-0.91429$). The estimation calculation of the Utsu method shows that aftershocks are predicted to end on the 1170th day ($r=-0.91412$) and the estimated results of the calculation of the Omori method of aftershocks are predicted to end on the 453th day ($r=0.886$). These results indicate that the most suitable method for predicting the end time of aftershocks is the Mogi II method, which ends on the 22nd day ($r=-0.91429$).

Keywords: *Forecasting, Aftershocks Decay, Mogi , Omori, Utsu*



LSTM METHOD FOR PREDICTION OF EARTHQUAKES (2022) USING GNSS TEC DATA

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Abstract

The ionosphere may play an essential role in the prediction of earthquake. The main parameter for investigating the structure of the ionosphere is Total Electron Content (TEC). In this article, a new method for seismic ionospheric Global Navigation Satellite System (GNSS) Total Electron Content (TEC) based anomaly detection using a deep learning framework is proposed. This article analyses the relations between earthquakes and TEC data to detect earthquakes. The earthquakes are : (1) Peru ($4^{\circ}27'58.0''S$, $76^{\circ}55'41.9''W$) on 3 February 2022 (M=6.5), (2) Japan ($37^{\circ}42'47.5''N$, $141^{\circ}34'45.5''E$) on 16 March 2022 (M=7.3), (3) Nicaragua ($11^{\circ}33'13.3''N$, $86^{\circ}57'37.4''W$) on 21 April 2022 (M=6.6). Our goal is to propose a prediction model to detect earthquakes in previous days that have occurred in 1st January to 30th June 2022. After reviewing the literature, long short-term memory (LSTM) is found to be a good option for building the model because of its memory-keeping ability. A type of recurrent neural network called Long Short-Term Memory (LSTM) is used to model the sequence of earthquakes. The trained model is then used to predict the future trend of earthquakes.

Keywords: *Ionosphere, TEC, earthquake, GNSS, neural network, LSTM, prediction*



ON Mw 6.1 KOPILI FAULT EARTHQUAKE OF APRIL 28, 2021: SEISMOTECTONIC APPRAISAL

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Abstract

The Mw 6.1 earthquake of April 28, 2021 (epicenter 26.690N, 92.360E; centroid depth 40 km GCMT report, www.globalcmt.org) in the Sonitpur district of Assam valley, North East (N.E.) India, occurred at the Kopili fault (K.F.) zone, a long transverse structure that traverses the valley. With a maximum strength of MMI VI, the earthquake caused a few fatalities/injuries and damage to structures, ground cracks, fountains, liquefactions, landslides, and other manifestations in various regions of the valley. The K.F. is recognized to be seismically very active fault, having triggered two big earthquakes ($M_w > 7.0$) in the past (1869 and 1943) and numerous intensely felt earthquakes ($M_w > 5.0$) in recent years. The fault plane solutions of the main shock and six aftershocks ($M_w > 3.5$) that occurred on April 28, 2021, are obtained using waveform inversion utilizing broadband seismograms from the closest observatory, Tezpur. The solutions agree with the known right-lateral strike-slip motion at the K.F. zone and are equivalent to the GCMT solution of the mainshock. The low-stress dips of the earthquake series suggest a prolonged source duration and modest coseismic slip of both the mainshock and the aftershocks. The low stress decrease in energy release may be attributable to reactivation of the K.F. The decrease in stress also indicates the presence of a fault zone at a higher depth. In the K.F. zone, a stress inversion analysis of the available 17 fault plane solutions reveals a compressional NNE–SSW and tensional NNW–SSE stress regime.

Keywords: Mainshock, aftershocks, fault plane solutions, waveform inversion



EFFECT OF CHANGE IN COULOMB STRESS ON GUTENBERG-RICHTER LAW FOR THE SEISMICITY OF KOPILI FAULT ZONE, ASSAM, NORTH-EAST INDIA

Nabajyoti Molia^{1,2}, Timangshu Chetia¹ and Santanu Baruah^{1,2*}

¹CSIR-North East Institute of Science and Technology, Jorhat-785006, Assam, India

²Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, UP, India

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Abstract

North East Region (NER) of India and its surroundings, seismically a most active region in the world, experience a complex stress system due to collision tectonics in the Himalayas to the north and subduction tectonics below Indo-Burma ranges to the east. Coulomb-stress theory is used to evaluate how one earthquake trigger another. While Gutenberg-Richter law is a landmark theory of theoretical seismology as well as hallmark for seismic hazard assessment. The Kopili fault zone (KFZ), 300 km long and 100 km wide, in the Assam valley is one of the most active intraplate fault zone in this region. In present study, 17 earthquakes ($M_w \geq 6.0$) within the Kopili Fault Zone, Assam have been considered to estimate b-values for respective 18 subsets falling between two events. We have also calculated Coulomb stress changes ($\Delta\sigma_f$) for five felt earthquakes and an attempt have been made to establish a relationship between coulomb stress changes ($\Delta\sigma_f$) and b-value. From our observation, we found that during last three decades (1984-2021) the b-value is much stable and low at 0.66-0.72. This low b-value may indicate that the presently the Kopili Fault Zone is under much tectonic stress. We also observed a negative correlation between coulomb stress changes ($\Delta\sigma_f$) and b-value for the period 1976-2021. To check the robustness and adequacy of the relation, we implemented linear regression model and a raw source regression equation for 5 earthquakes events which have been established as $b\text{-value} = -0.049 \Delta\sigma_f - 0.009$, with a correlation coefficient $R^2 \sim 0.804$. This relation could be an effective tool in seismic hazard analysis for the Kopili Fault Zone.

Keywords: *Coulomb stress changes, b-value, linear regression, Kopili fault zone*



CRUSTAL SHEAR WAVE VELOCITY STRUCTURE OF NORTH-EAST INDIA BY SURFACE WAVE DISPERSION ANALYSIS

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¹CSIR-North East Institute of Science and Technology, Jorhat, Assam

²Academy of Scientific and Innovative Research, Ghaziabad, UP

*email: santanub27@gmail.com

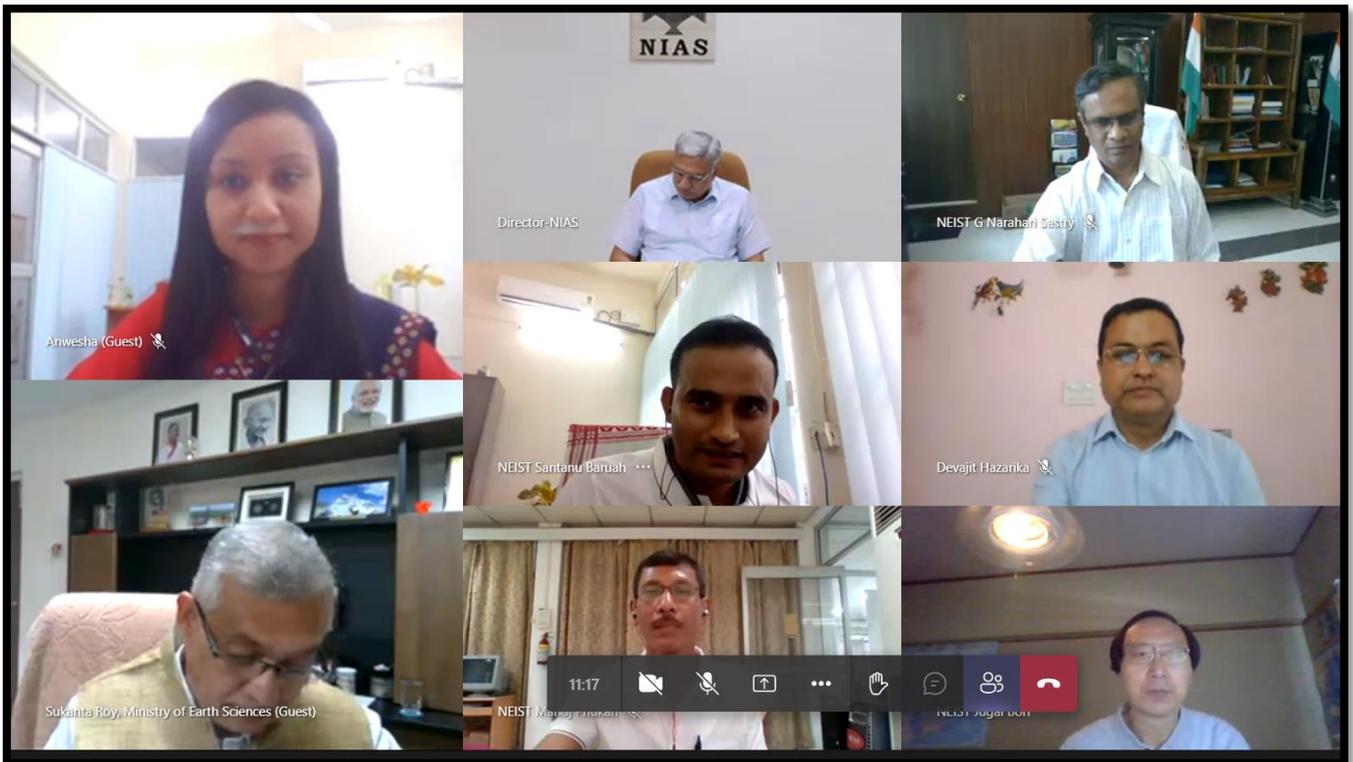
Abstract

A 1D shear - velocity model for the crust and upper mantle beneath North East India Region is determined from the analysis of fundamental- mode Rayleigh- wave group velocity. In the present study, we use teleseismic data recorded by Broadband Station Network of CSIR-North East Institute of Science and Technology, Jorhat. The elastic structure beneath the study area is shown by means of S-velocity maps for depths ranging from 0 to 400 km. The traces of 55 earthquakes, occurring from 2005 to 2015, have been used for Rayleigh-wave dispersion analysis. The dispersion curves were obtained for periods between 5s and 250 s, by digital filtering viz. MFT (*Multiple filtering technique*) and TVF (*Time variable filtering*). All the earthquake events are grouped for each source-station path and were further regionalised and inverted according to the generalized inversion theory, to obtain a shear wave velocity model. The obtained S-velocity model will accord with the lateral and vertical heterogeneities that are already there. Applying a combination of different filtering techniques and inversion method, shear wave velocity structure was determined as functions of depth. These results will agree with the geology and other geophysical results from previous studies.

Keywords: Rayleigh wave, dispersion curve, multiple filtering technique, 1D shear velocity model

4. *Photo Gallery*

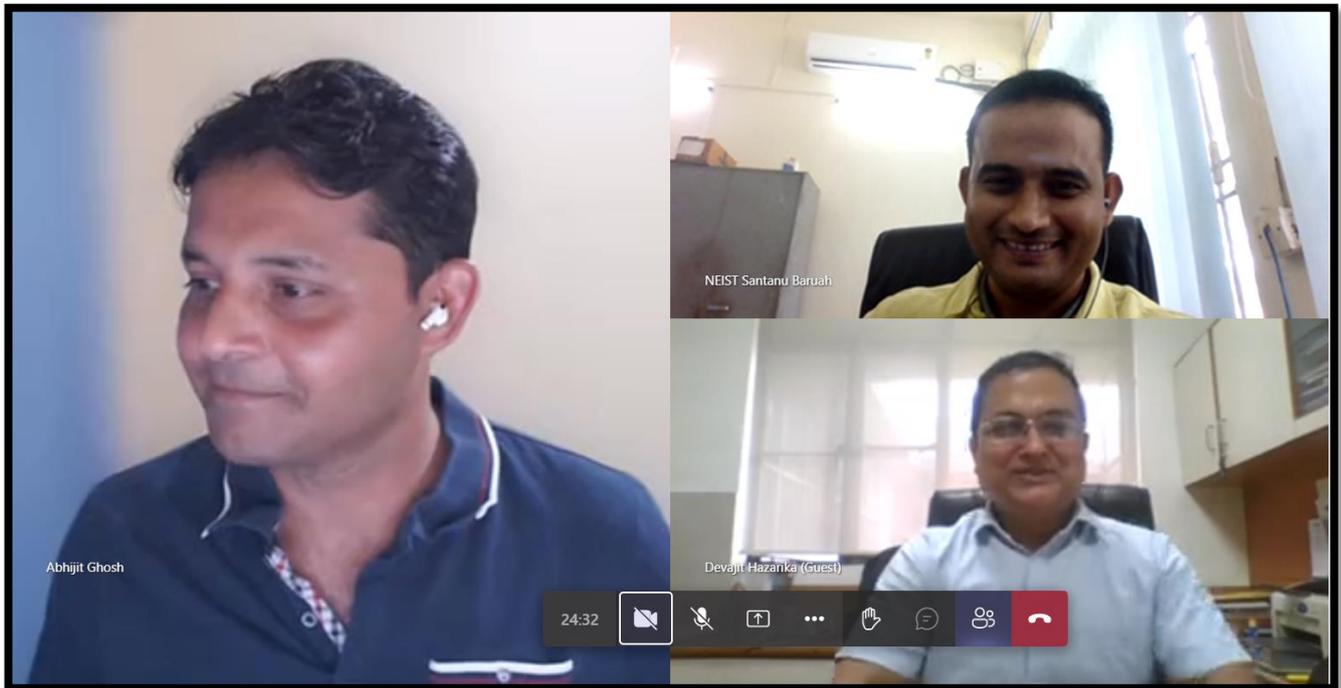




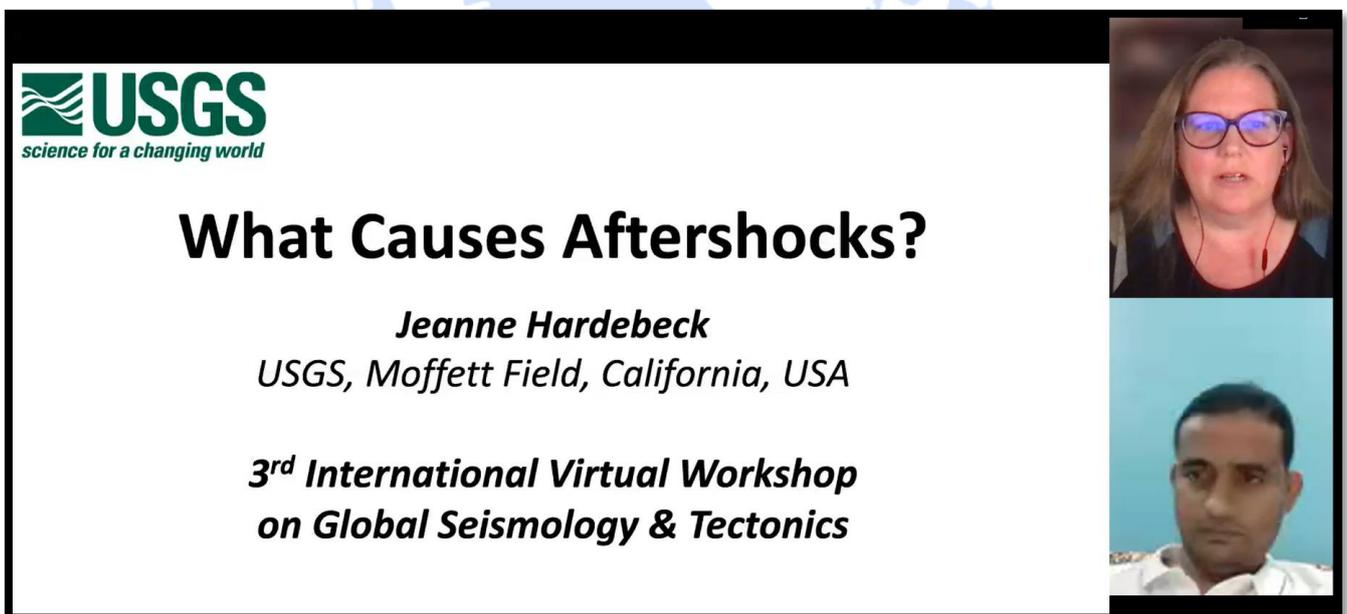
Inauguration ceremony of IVWGST-2022 featuring (In clockwise direction starting from upper right) Dr. G. Narahari Sastry, Director, CSIR-NEIST; Dr. Devajit Hazarika, WIHG; Prof. Dapeng Zhao, Tohoku University, Japan; Dr. Manoj K. Phukan, CSIR-NEIST; Dr. Sukanta Roy, Director, BGRL (MoES); Miss Anwesha Dutta Hazarika, CSIR-NEIST; Dr. Shailesh Nayak, Director, NIAS and Convener Dr. Santanu Baruah, CSIR-NEIST (at the centre).



During day 1 of IVWGST-2022: Dr. Chinmoy Rajkonwar, CSIR-NEIST (In clockwise direction starting from upper left) while proposing vote of thanks to the dignitaries and participants after the successful conduction of the first day lecture by Dr. Sailesh Nayak, Director, NIAS. Dr. Sukanta Roy, Director, BGRL (MoES) and the convener of IVWGST-2022 Dr. Santanu Baruah, CSIR-NEIST is also seen on the right hand corner of the panel (Date: 20th September, 2022).



During day 2 of IVWGST-2022: Dr. Abhijit Ghosh, University of California, USA (left panel) is having an interaction with Convener Dr. Santanu Baruah, CSIR-NEIST (right panel top) and session's co-chairperson Dr. Devajit Hazarika, WIHG (right panel bottom) after delivering his lecture (Date: 21st September, 2022).



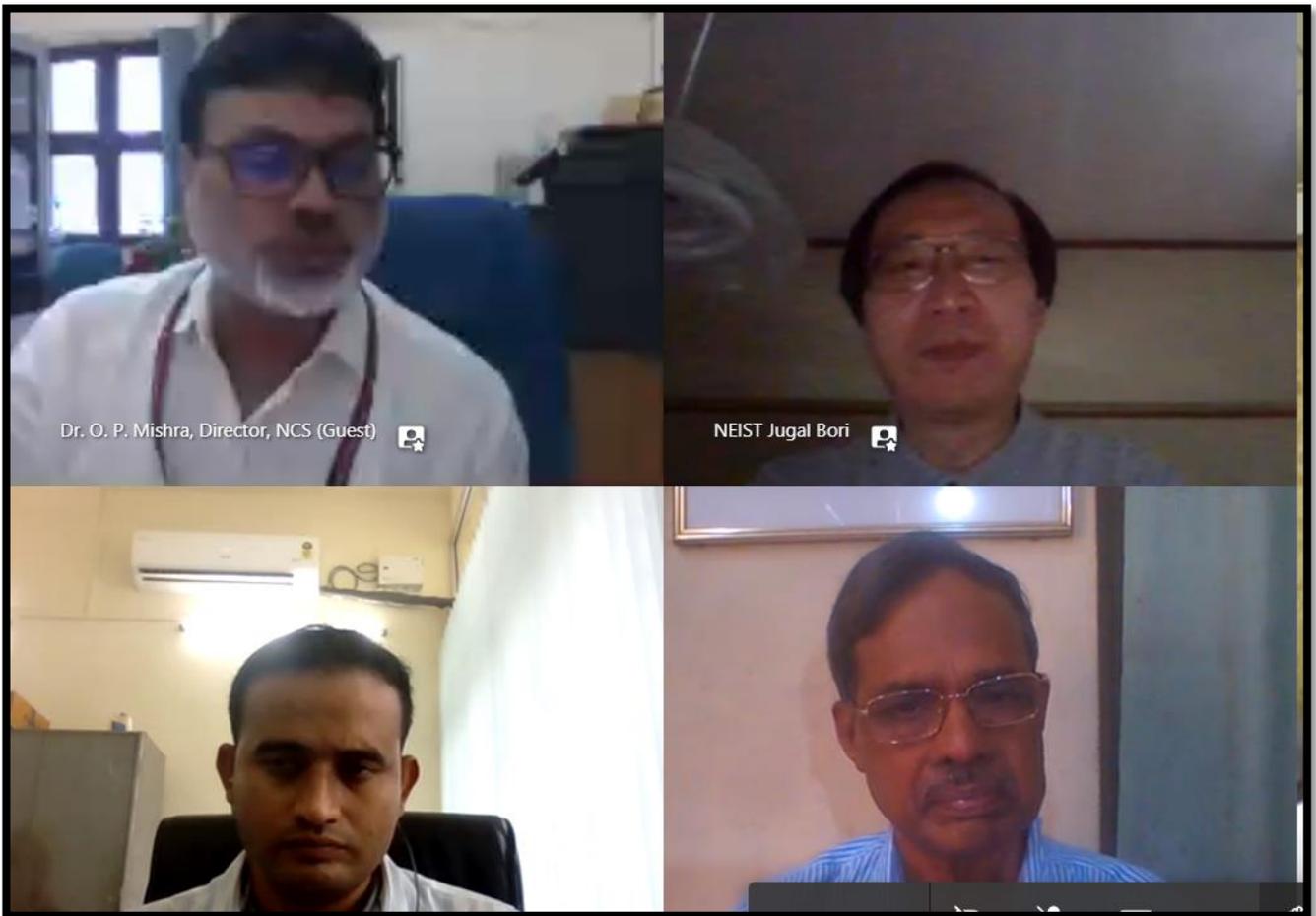
USGS
science for a changing world

What Causes Aftershocks?

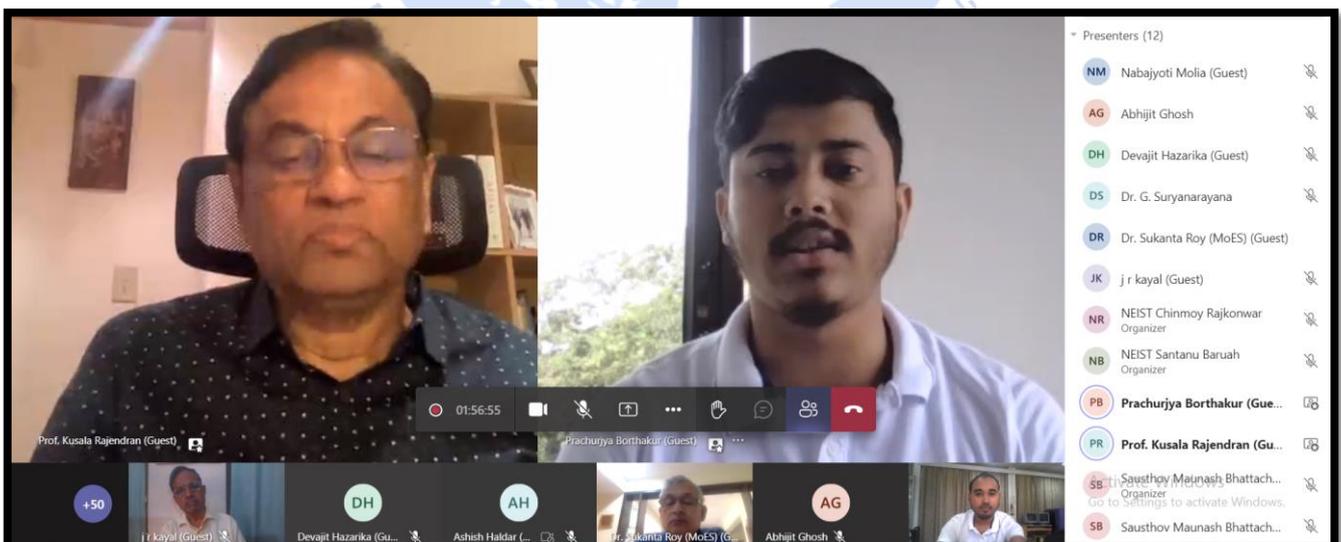
Jeanne Hardebeck
USGS, Moffett Field, California, USA

**3rd International Virtual Workshop
on Global Seismology & Tectonics**

During day 3 of IVWGST-2022: Keynote speaker of the session Dr. Jeanne Hardebeck, USGS (Right panel top) while delivering her talk to the audience of IVWGST-2022. Convener of the workshop Dr. Santanu Baruah, CSIR-NEIST is also seen at the bottom of the right panel (Date: 22nd September, 2022).



During day 4 of IVWGST-2022: Post lecture interaction among the keynote speaker Prof. Dapeng Zhao, Tohoku University, Japan (In clockwise direction starting from upper right) ; Prof. J.R. Kayal, Ex-DDG, GSI; Dr. Santanu Baruah, Senior Scientist, CSIR-NEIST and Dr. O.P. Mishra, Director, NCS (Date: 23rd September, 2022).



During day 5 of IVWGST-2022: Mr. Prachurjya Borthakur, CSIR-NEIST (Upper right of the panel) while proposing vote of thanks to the dignitaries and participants after the successful conduction of the keynote lecture by Prof. C.P. Rajendran, NIAS, Bengaluru (Upper left of the panel) featuring session's chairperson Prof. J.R. Kayal, Ex-DDG, GSI; Dr. Sukanta Roy, Director, BGRL (MoES) and Mr. Nabajyoti Molia, CSIR-NEIST (left to right in the bottom row) (Date: 24th September, 2022).

The slide features the Government of India emblem and the 75th anniversary logo. The title is "Deep drilling and downhole measurements / monitoring to understand earthquake processes: a study from the Koyna seismogenic zone, India". The speaker is Sukanta Roy, Director of Borehole Geophysics Research Laboratory, Karad. Acknowledgements are given to mentors and colleagues at MoES, BGRL, and CSIR-NGRI. The participant list on the right includes SC, A, SB, BP, DR, DC, SB, and PB.

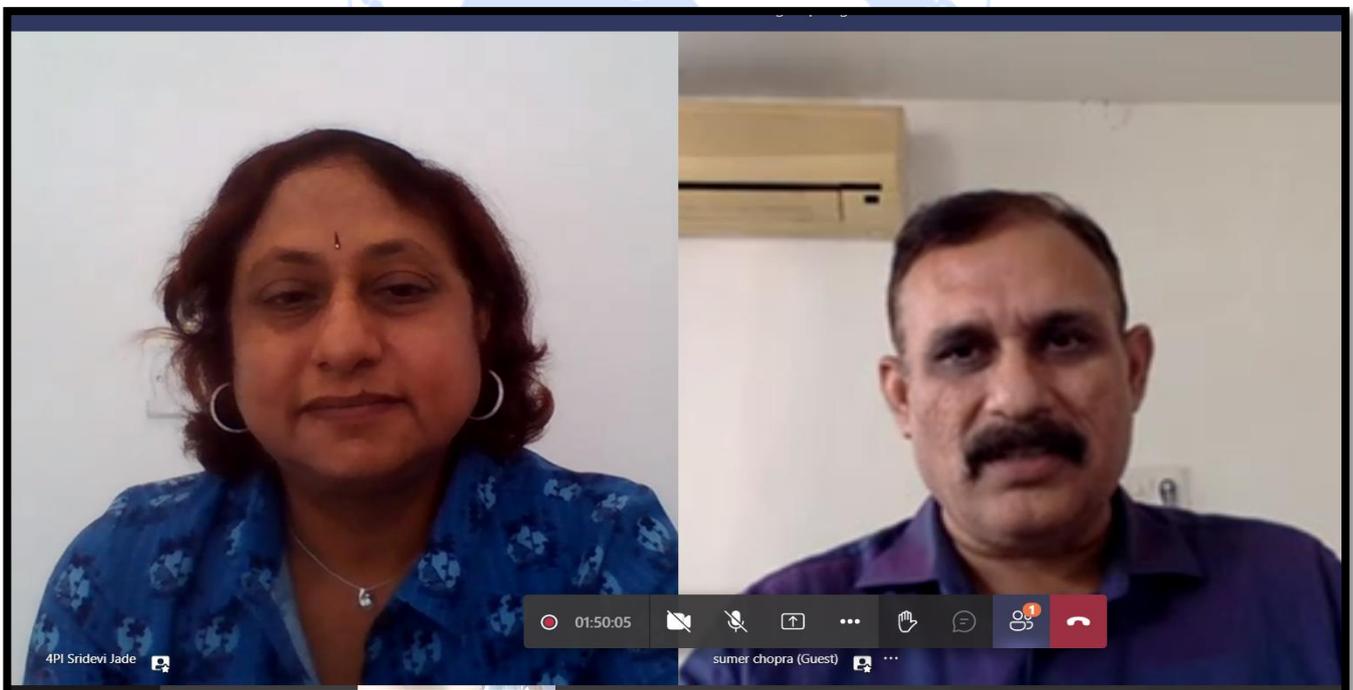
During day 6 of IVWGST-2022: Keynote speaker of the session, honourable director of Borehole Geophysics Research Laboratory (BGRL), MoES Dr. Sukanta Roy while delivering his lecture to the audience of IVWGST-2022 (Date: 25th September, 2022).

The screenshot shows two women in a video call. The woman on the left is Dr. Margarita Segou, and the woman on the right is Dr. Sridevi Jade. A 'People' sidebar on the right lists 14 presenters, including Nabajyoti Molia, 4PI Sridevi Jade, Bijit Kumar Choudhury, Bijit4u, Chandan Dey, j r kayal, kvrh prasad, margarita, NEIST Chinmoy Rajkonwar, and NEIST Manoj Phukan.

During day 7 of IVWGST-2022: Dr. Margarita Segou, British Geological Survey, UK (left panel) is having an interaction with honourable Head of CSIR-4PI, Dr. Sridevi Jade (right panel) after delivering her lecture (Date: 26th September, 2022).



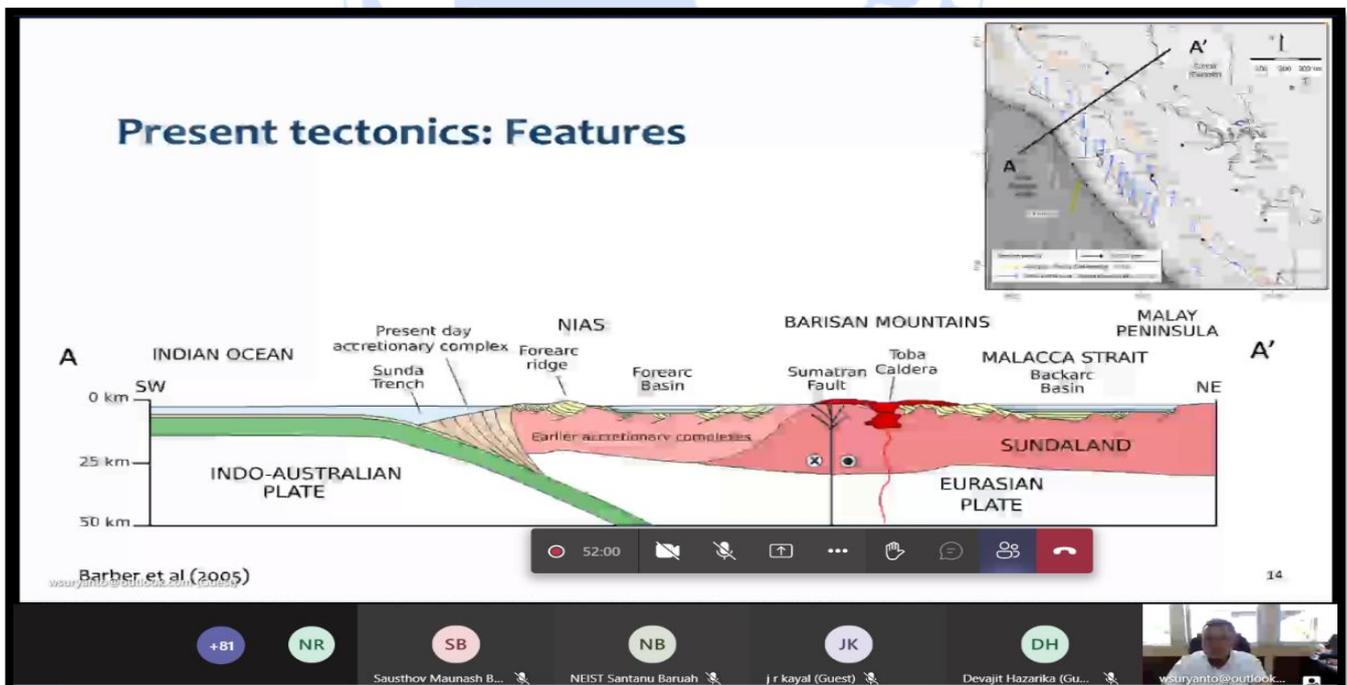
During day 8 of IVWGST-2022 (morning session): Keynote speaker of the session; director of ISR, Gujarat, Dr. Sumer Chopra while delivering his talk on the Seismicity in Intraplate Gujarat region (Date: 27th September, 2022).



During day 8 of IVWGST-2022 (afternoon session): Post lecture interaction between keynote speaker of the session, Dr. Sridevi Jade, director, CSIR-4PI, Bangalore and Dr. Sumer Chopra, director, ISR, Gujarat (Date: 27th September, 2022).



During day 9 of IVWGST-2022: Dr. Justin Rubinstein, USGS, USA (left panel) is having an interaction with session co-chairperson Dr. Wiwit Suryanto, UGM, Indonesia (right panel) after delivering his keynote lecture. Convener of the workshop Dr. Santanu Baruah, CSIR-NEIST and Co-convener & Head of GSTD, CSIR-NEIST Dr. M.K. Phukan is also seen in the panel (right to left) (Date: 28th September, 2022).



During day 10 of IVWGST-2022 (morning session): Keynote speaker of the session, Dr. Wiwit Suryanto from UGM, Indonesia while delivering his talk on Crustal Anisotropy along the Great Sumatran fault zone from Receiver function (Date: 29th September, 2022).

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

3-D Seismic Velocity Structure of the Lithosphere and its Geodynamic Implications for the Western Himalayas, Western Himalayan Syntaxis, and Pamir-Hindu Kush Region

Sagarika Mukhopadhyay
Department of Earth Sciences, IIT Roorkee, Roorkee-247667, Uttarakhand
Email: sagarika.mukhopadhyay@es.iitr.ac.in, sagarfes@gmail.com

teams 24:40

Sagarika Mukhopadhyay (Guest)

+31 AH NB JK DH

NEIST Santanu Baruah j r koyal (Guest) Devajit Hazarika (Gu... NEIST Chinmay Raj...

During day 10 of IVWGST-2022 (afternoon session): Keynote speaker of the session, Prof. Sagarika Mukhopadhyay (bottom right corner) from IIT-Roorkee while delivering her lecture to the audience of IVWGST-2022 (Date: 29th September, 2022).

Induced (and Triggered) Earthquakes

Earthquakes whose occurrence in space and time is related to anthropogenic activities that cause changes to the pressures (especially of fluids) within the Earth's crust

Direct fluid pressure effects of injection (fluid pressure diffusion)

Well

Fault

Permeable reservoir/aquifer

Increase in pore pressure along fault (requires high-permeability pathway)

Changes in solid stress due to fluid extraction or injection (poro-thermoelastic effects, changes in gravitational loading)

Permeable reservoir/aquifer

Volume and/or mass change

Fault

Change in loading conditions on fault (no direct hydrologic connection required)

Ellsworth (2013)

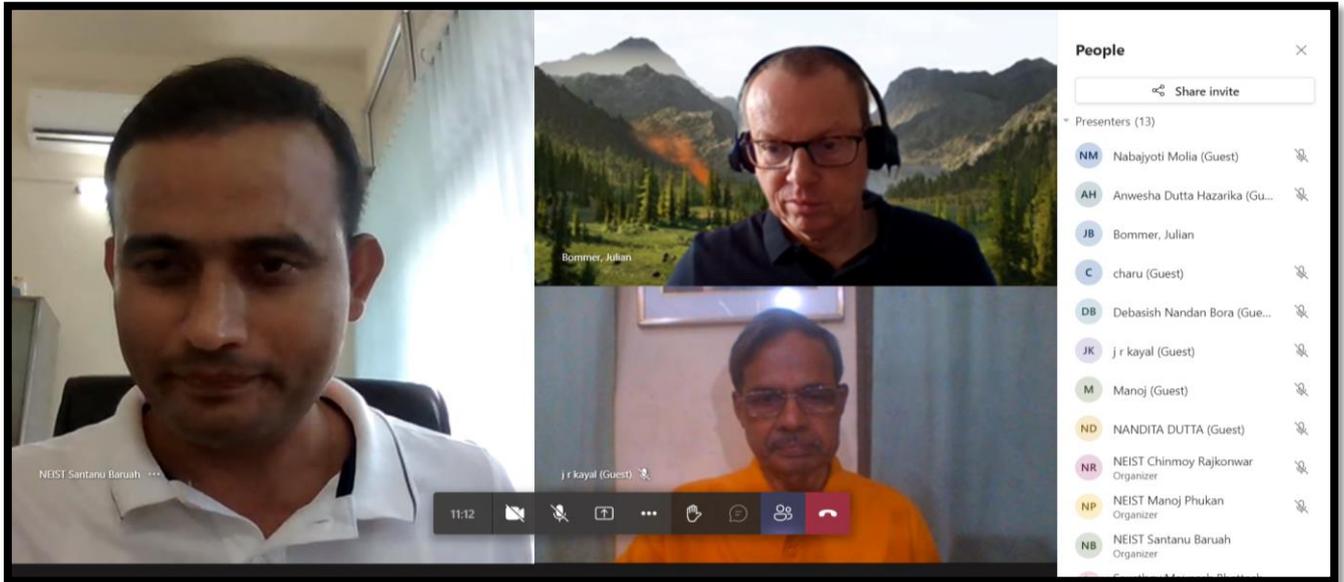
20:33

Bommer, Julian

+52 S SC NB AH JK

Bommer, Julian sumer chopra (Guest) NEIST Santanu Baruah Anvesha Dutta Haza... j r koyal (Guest)

During day 11 of IVWGST-2022: Prof. Julian J. Bommer from Imperial College of London, UK while delivering his keynote talk to the audience of IVWGST-2022 (Date: 30th September, 2022).



Valedictory Session of IVWGST-2022 featuring (in clockwise direction starting from left panel) Dr. Santanu Baruah, Senior Scientist, CSIR-NEIST; Prof. Julian J. Bommer, Imperial College of London, UK & Prof. J. R. Kayal, ex-DDG, GSI, Govt. of India ; Adjunct Prof. of NIT-Agartala (Date: 30th September, 2022).



Dr. Santanu Baruah, convener of IVWGST-2022 while proposing vote of thanks in the valedictory Session featuring (from left to right in row) Mr. Saushtov M. Bhattacharjee, CSIR-NEIST; Dr. Manoj K. Phukan, CSIR-NEIST; Prof. J. Bommer, Imperial College in London, UK; Dr. Wiwit Suryanto, UGM, Indonesia; Miss Anvesha Dutta Hazarika, CSIR-NEIST & Mr. Nabajyoti Molia, CSIR-NEIST (Date: 30th September, 2022).



5. List of Participants



1. List of International participants (48)

SL No.	Full Name	Nationality	Gender	Address in country of residence
1	Hari Ram Thapa	Nepalese	Male	Ishworpur-7,Sarlahi,Madhesh Pradesh,Nepal,44600
2	Dr. Januka Attanayake	Sri Lanka	Male	Australia,Melbourne,Victoria,Australia,3010
3	Md. Azahar Hossain	Bangladeshi	Male	10/1/A Gonoktuly Lane BGB 1 No. Gate, Peelkhana,Dhaka,Dhaka,Bangladesh,1205
4	Abdussalam Muhammad Auwal	Nigerian	Male	No. 13, Gadau Road, Kafin Kuka,Azare,Bauchi,Nigeria,751101
5	KHALED ABDELLAH MAHMOUD OMAR	Egyptian	Male	National Research Institute of Astronomy and Geophysics,Abu Tisht, Qena,cairo,Egypt,11421, Helwan
6	Oluwasegun Solomon Babalola	Nigerian	Male	23, Joseph avenue, Sangotedo market bus stop, Sangotedo, Ajah, Lagos.,Ajah,Lagos,Nigeria,101245
7	Ram Krishna Tiwari	Nepalese	Male	Chitwan, Nepal,Narayangarh ,Bagmati,Nepal,977
8	Mst. Sirajum Monira	Bangladeshi	Female	Geological Survey Of Bangladesh, 153 Pioneer road, Segunbagicha, Dhaka,Dhaka,Dhaka,Bangladesh,1217
9	Moruffdeen Adedapo	Nigeria	Male	Plot 10 Block XXXVIIA T&B Adabanija Close, Oke'badan Estate, Akobo ,Ibadan,Oyo State ,Nigeria ,210000
10	Mohamed fadel	Egyptian	Male	Helwan, Elmarsad St ,Cairo ,Cairo,Egypt,11722
11	Sani Usman	Nigeria	Male	No. 9 Habu Muazu Crescent, Federal Low Cost Quarters Gombe, Gombe State.,Gombe,Gombe,Nigeria,760235
12	Shaimaa Ali Maamoun	Egyptian	Female	15th May City, neighborhood 15, group9, building no9, Cairo, Egypt ,Helwan ,Cairo ,Egypt,11722
13	Anik Hilyah	Indonesia	Female	Sukolilo,Surabaya,Jawa Timur,Indonesia,60111
14	Josephus Ronny Kelibulin	Indonesia	Male	Jl.Ir.M.Putuhenā, Kampus Poka, Ambon,Ambon,Maluku,Indonesia,97122
15	Shila Bhattarai	Nepalese	Female	Panchkhal-5,Kavrepalanchok,Bagmati,Nepal,977
16	Oluwaseyi Adeola Dasho	Nigerian	Male	5 Oluwabamigbe street, Yaba ,Ondo,Ondo State ,Nigeria ,23401
17	Musa Olufemi AWOYEMI	Nigerian	Male	2nd Avenue, House 16, Ooni Crown Land Estate, off Ede Road.,Ile-Ife,Osun,Nigeria,220005
18	Jayanath Bandara Herath	Sri Lanka	Male	106/1, Mawathupola, Alawathugoda, Kandy, Sri Lanka,Kandy,Central,Sri Lanka,20140
19	ELUYEMI AYODEJI ADEKUNLE	NIGERIA	Male	8, ITAOLOPO STREET, ILE-IFE, OSUN STATE, NIGERIA.,ILE- IFE,OSUN,Nigeria,220005
20	Shedrack Samuel Bwala	Nigerian	Male	Damboa Road,Maiduguri,Borno state,Nigeria,600104
21	Dilli Ram Thapa	Nepali	Male	Besishahar, Lamjung, Nepal,Lamjung ,Gandaki,Nepal,33600
22	ISAAC MONNY	GHANA	Male	NKAWKAW DOMEABRA,Nkawkaw,EASTERN,GHANA,233
23	Abdullah Mohammed Keita	Liberia	Male	Adana Turkey ,Adana,Cukurova,Turkey,1130
24	Fidelis Ankwo Abija	Nigerian	Male	Centre for Geomechanics, Energy and Environmental Sustainability, Port Harcourt, Nigeria.,Port Harcourt,Rivers,Nigeria,0
25	SOMAK HAZRA	Indian	Male	FLAT 3C, 22F NEPAL BHATTACHARJEE 1ST LANE,KOLKATA,WEST BENGAL,Indian,700026
26	Juan Luis	Mexican	Male	Jose Maria Lopez Leyva # 39, Pericos,Mocorito,Sinaloa,Mexico,80950
27	Masoud Ghamari	Iranian	Male	Iran, Hamedan, Bahar, Azadegan square, behind Baharan hall, Iman 3 alley,Bahar,Hamedan,Iran,6531949738
28	R.M.T.Uthpala Rathnayake	Sri Lankan	Female	Udakubura,Doranagama, Medawala, Harispaththuwa,Kandy,Central Province,Sri Lanka,20120
29	Muhammad Abubakar umar	Nigeria	Male	Opposite Pantami Police Division,Gombe,Gombe,Nigeria,760253
30	Julian J Bommer	British	Male	19 Cross Deep Gardens,Twickenham,Middlesex,United Kingdom,TW1 4QZ
31	EMMANUEL EMEKA EZENWOYE	Nigerian	Male	Area A Block 10, Nyanya, Abuja, Nigeria,Abuja,Federal Capital Territory,Nigeria,900103
32	Abhijit Ghosh	USA	Male	3120 Maricopa Drive,Riverside,California,USA,92507
33	Jeanne Hardebeck	USA	Female	861 Jasmine Drive,Sunnyvale,California,USA,94086
34	Justin Rubinstein	USA	Male	520 Buchanan St. Apt. 3,San Francisco,CA,USA,94102
35	Rintu Roy	Bangladeshi	Male	B-58/1, Kazi Mokma Para, Savar,Dhaka,Dhaka,Bangladesh,1340
36	Hasan Firat Altinyuzuk	Turkey	Male	Aydin,Aydin ,Aydin ,Turkey,9000
37	Peter	Nigeria	Male	61, bluebell crt, flat 3, tric lc-cern,Malta,Saint Paul's Bay,Malta,spb



38	Apsara Sharma Dhakal	Nepali	Female	Satungal, kathmandu, Nepal, Syangja, Syangja, Nepal, 44600
39	Pinar Buyukakpinar	Turkish	Female	GFZ-Potsdam Helmholtzstrabe 6/7 14467 Potsdam, Potsdam, Brandenburg, Germany, 14467
40	Nilmani Regmi	Nepali	Male	Tulsipur-16, Dang, Nepal, Dang, Lumbini, Nepal, 44600
41	ADENIKA CHARLES ITUNU	NIGERIA	Male	28, IFEOLUWASOGO STREET, SABO, ONDO, ONDO, NIGERIA, 340001
42	Dr Margarita Segou	Greek	Female	18 Granton Mill Park, Edinburgh, Edinburgh, City of, United Kingdom, EH4 4UU
43	A. K. M. Khorshed Alam	Bangladeshi	Male	Sujapur, Phulbari, Dinajpur, Dinajpur, -, Bangladesh, 5260
44	Minhazul Abedin Shakik	Bangladeshi	Male	Mymensingh Bangladesh, Mymensingh, Dhaka, Bangladesh, 1000
45	Selvan Sathiyarajan	Indian	Male	B-707, Grassland, Kolhewadi, Pune, Maharashtra, India, 411024
46	Jimmi Nugraha	Indonesia	Male	Jl. Syech Yusuf, Perumahan Griya Mutiara Timur 3 No. 33 Kobbang, Gowa, South Sulawesi, Indonesia, 10720
47	Dapeng Zhao	USA	Male	Tohoku University House, Aoba-Ku, Sendai, Japan
48	Wiwit Suryanto	Indonesia	Male	Dsn. Nusupan RT.04/RW 29, Trihanggo, Gamping, Sleman, Yogyakarta, Indonesia

2. List of Indian participants (480)

SL. No.	Full Name	Nationality	Gender	Address in country of residence
1	Dr. Timangshu Chetia	Indian	Male	Hospital Road, Bokakhat, Assam, Bokakhat, Assam, India, 785612
2	Ms. Kristi Saikia	Indian	Female	Mancotta, Teporgaon, Dibrugarh, ASSAM, India, 786003
3	Ms. Simpee Boruah	Indian	Female	Bharalua gaon, Chabua, Dibrugarh, Assam, India, 786184
4	Mr. Abhishek Mukhia	Indian	Male	Doorkhola samabeong tea estate, PO lava, kalimpong, West Bengal 734319, Kalimpong, West Bengal, India, 734319
5	Ms. Nihali Baruah	Indian	Female	Noonmati, Guwahati, Kamrup Metropolitan, Assam, Indian, 781020
6	Mr. RUHAN BORAH	Indian	Male	Hanchara Chetia Gaon, JORHAT, Assam, India, 785683
7	Mr. DEEPENDRA YADAV	Indian	Male	Vill. - Hardi, P.O. - Jamie Pandit, Maharajanj, UTTAR PRADESH, India, 273207
8	Dr. R B S Yadav	Indian	Male	Department of Geophysics, Kurukshetra University, Kurukshetra, Haryana, Kurukshetra, Haryana, India, 136119
9	Mr. AJAY	Indian	Male	VPO KAMALPUR TEH. KALAYAT DISST. KAITHAL 136117, KAITHAL, HARYANA, Indian, 136117
10	Dr. CHINGTHAM PRASANTA SINGH	Indian	Male	C/O CHINGTHAM KUNJABIHARI SINGH, HAOBAM MARAK IROM LEIKAI, NEAR COMMUNITY HALL, IMPHAL-WEST, MANIPUR, MANIPUR, 795001
11	Mr. Atul Kumar	Indian	Male	Vill Bichhiya, Po Kallua Moti, Lakhimpur Kheri, Uttar Pradesh, India, 261505
12	Mr. Shubham Yadav	Indian	Male	House no. 312/2 New Ranjit Nagar, Shahabad Markanda, Kurukshetra, Haryana, India, 136135
13	Dr. Deepjyoti Goswami	Indian	Male	BGRL-MoES, Karad-Vita road, Hajarmachi, Karad, Satara, Maharashtra, India, 415105
14	Mr. ASHUTOSH GOGOI	Indian	Male	Maduri pathar, silapathar, dhemaji, Assam 787059, Dhemaji, Assam, India, 787059
15	Dr. Arun Prasath R	Indian	Male	66/2, Pettai Street, Yethapur, PN Palayam, Salem, Tamil Nadu, India, 636117
16	Dr. A.M.Sakthivel	Indian	Male	Salem, Salem, Tamil Nadu, India, 636309
17	Ms. Ronak	Indian	Female	V.P.O Garhi sisana, Teh.- Kharkhoda, Sonapat, Haryana, India, 131408
18	Ms. Anamika Sahu	Indian	Female	S 17/95 P 11 K nadeshwar cantt varanasi, Uttar Pradesh, Varanasi, Uttar Pradesh, India, 221001
19	Ms. ESHA SREE.M	Indian	Female	39/2A3, Sree illam, Eswari Garden, Kannankurichi, Salem-08., Salem, Tamilnadu, India, 636 008
20	Ms. RADHIKA R	Indian	Female	Parakode Veedu, Chempazhanthu P. O. PIN: 695587, Trivandrum, Kerala, India, 695587
21	Mr. Angshuman Kashyap	Indian	Male	Dhapkata, RRL, Jorhat, Assam, Jorhat, Assam, India, 785006
22	Ms. Nidhi Parashar	Indian	Female	E 272, Railway Colony, near Angreji Bazar, Bandikui, Dausa, Rajasthan, India, 303313
23	Mr. Anupol bora	Indian	Male	Cinnamara, Jorhat, assam, Jorhat, Assam, India, 785008



3rd International Virtual Workshop on Global Seismology and Tectonics

Organized by Geosciences & Technology Division (GSTD), CSIR-NEIST, Jorhat, Assam (India)

20th – 30th, September 2022



24	Mr. Arindam Saikia	Indian	Male	Kuhumjugonia gaon, jorhat,Jorhat,Assam,India,785001
25	Mr. Rohit Chauhan	Indian	Male	Abhishek nagar near petrol pump sarsawa saharanpur,Saharanpur,Uttar Pradesh,India,247232
26	Mr. HARIHARAN R	Indian	Male	318, Muruganandi street, Chinnaputhur, Salem-7.,Salem ,Tamilnadu ,India,636007
27	Mr. SWAMYNATHAN G	Indian	Male	188/384, AMBAYIRAM CHAVADI STREET, AMMAPET MAIN ROAD, SALEM - 636001.,SALEM,TAMILNADU,Indian,636001
28	Dr. A. ARUN KUMAR	Indian	Male	42, Mariamman Koil street, St. Paul Pet Pondicherry 605008,Pondicherry,Puducherry,India,605008
29	Mr. ANURAG BHARADWAJ	Indian	Male	Dhapkata RRL Jorhat ,Jorhat ,Assam ,India,785006
30	Ms. Anwasha Dutta Hazarika	Indian	Female	No.2 Brahmin Gaon, P.O. Chengeli Gaon, Jorhat,Jorhat,Assam (AS),India,785010
31	Dr. Rajkumari Mrinalinee Devi	Indian	Female	Sega Road Takhelambam Leikai, Imphal-795001,Imphal West District,Manipur,India,795001
32	Mr. HARIHARAN P K	Indian	Male	1/150, Kullampatti post, Ayothiyapattinam via, Valapady Taluk, ,SALEM,TAMILNADU ,Indian,636103
33	Dr. Dr. Chinmay Haldar	Indian	Male	Ratanpur, Mougram,Purba Barddhaman,Westbengal,India,713123
34	Ms. Vaishali Shukla	Indian	Female	96/6 JK colony Jajmau Kanpur ,Kanpur ,Uttar Pradesh,India,208010
35	Dr. Homnath Luitel	Indian	Male	Pakyong, Namchey Bong, east sikkim,,Pakyong,SIKKIM,India,737102
36	Mr. Anshuman Borthakur	Indian	Male	L.K. Path, Na-ali, Jorhat,Jorhat,Assam,India,785001
37	Mr. ACHYUT KUMAR DUARAH	Indian	Male	Gowaljan gaon, Athkhelia Golaghat, Assam P.O. Pulikaitoni PIN : 785631,Golaghat ,Assam ,India,785631
38	Dr. Chinmoyee Borpujari	Indian	Female	Guwahati ,Kamrup Metro ,Assam,India,781040
39	Mr. MD SOHAIL KHAN	Indian	Male	ALUPATTY,DIBRUGARH,ASSAM,Indian,786610
40	Mr. Antarip Hazarika	Indian	Male	Molaikumar gaon, PO Baruahbamun gaon , 785618, PS Dergaon, Golaghat, Assam,Golaghat,Assam,India,785618
41	Mr. Ankurjyoti Sarmah	Indian	Male	No 1 padumoni,Sarupathar,Golaghat,Assam ,Golaghat ,Assam,India,785601
42	Mr. Anirban Pathak	Indian	Male	Milannagar West By lane M, Dibrugarh, Assam ,Dibrugarh ,Assam,India,786003
43	Ms. Champa Banerjee	Indian	Female	Vill: Mancha, Post: Kushadwip, PS: Patrasayer, Dist: Bankura, State: West Bengal ,Bankura ,West Bengal, India-722207
44	Mr. Dibyalochan Mahanta	Indian	Male	At/Po- Bhanda,Kendujhar,Odisha,India,758044
45	Mr. Abhishek deori	Indian	Male	Rupai siding , Tinsukia,Tinsukia,Assam,India,786153
46	Mr. Abu Nasser Hussain	Indian	Male	Naharani, Dergaon, Golaghat, Assam,Golaghat,Assam,India,785618
47	Ms. Parismita Borah	Indian	Female	Gandhi nagar, Huwani path ,Dibrugarh,Assam,India,786001
48	Mr. PIYAL HALDER	Indian	Male	HALDER VILLA, VIDYASAGAR SARANI, P.O.+P.S.- BHADRESWAR,HOOGHLY ,WEST BENGAL ,Indian,712124
49	Dr. Abhishek Ravindra Lakhote	Indian	Male	B 101 Shankar Complex CHS Shivaji Path no 1 Ganesh Nagar Dombivli West,Thane,Maharashtra,India,421202
50	Ms. Shreya Shri	Indian	Female	D/O, Bhag Chand Chauhan, Near Vidhan sabha Gate, sidhbari, Dharamshala Distt. Kangra (HP),Kangra,Himachal Pradesh,India,176053
51	Ms. HARITHA CHANDRIYAN	Indian	Female	GOVIS ,KANNUR,KERALA,Indian,670641
52	Mr. Nabajyoti Molia	Indian	Male	Bozaltoli Gaon, Near DC office Tinsukia, Post Office: Borguri,Pin: 786126 Tinsukia, Assam,India
53	Mr. Pranjal Bora	Indian	Male	Sastipith, Choladhora. ,Jorhat. ,Assam,India,785001
54	Ms. REMA VAISHALI . M	Indian	Female	Type 1, 27 new harbour,Tuticorin,Tamilnadu,India,628004
55	Mr. C Prasanna Simha	Indian	Male	C2/1 ISR Campus , next to PDEU, Raisan Gandhinagar ,Gandhinagar ,Gujarat,Indian ,382009
56	Dr. Himangshu Paul	Indian	Male	Uppal,Hyderabad,Telangana,India,500039
57	Ms. Apaar Preet Kaur Bali	India	Female	Pondicherry ,Oulgaret,Puducherry ,India ,605010
58	Mr. Baba Sahil Sarkar	Indian	Male	Bilasipara ,Dhubri,Assam,India,783348
59	Ms. Liza Tamuli	Indian	Female	Junaki Path Rupai Siding Doomdooma ,Tinsukia,ASSAM,India,786153



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60	Mr. Deepjyoti Mahanta	Indian	Male	Dudhnoi , Babupara, Goalpara,783124,Goalpara ,Assam,India,783124
61	Mr. Akash Mondal	Indian	Male	Lapuria,Bankura,West Bengal,India ,722132
62	Mr. Abhishek Panda	Indian	Male	Muktapur, Chikiti ,Ganjam ,Odisha ,India,761010
63	Ms. BONIKA BURAGOHAIN	Indian	Female	Longkak Gohain Villege,Sivasagar,Assam,India,785685
64	Dr. ARUNKUMAR K. S	Indian	Male	Arunodayam, Sreenivasapuram P. O, Varkala -695145, Thiruvananthapuram, Kerala,Thiruvananthapuram ,Kerala,India,695145
65	Mr. Amrish Saini	Indian	Male	1017, Saraswatipuram, Hazari bagh, Kankhal,Haridwar,Uttarakhand,India,249408
66	Ms. ESTHER LALTHANKIMI	Indian	Female	Kulikawn,Aizawl,Mizoram,India,796005
67	Ms. Kuki Monjori Boruah	Indian	Female	N.S. Area, Digboi,Tinsukia ,Assam ,India,786171
68	Mr. BITTU SINGHA	Indian	Male	CHIRAKUTI, KAILASHAHAR, TRIPURA,UNAKOTI,TRIPURA,Indian,799277
69	Mr. Jigyas Boruah	Indian	Male	T.H.Road, Ward no-7, P.O. North Lakhimpur, Dist. Lakhimpur, Pin-787001, Assam, India,Lakhimpur,Assam,India,787001
70	Mr. Azizul Hoque	Indian	Male	Vill: Kayakuchi Gaon, P.o: Nali Gaon, Dist: Barpeta,Barpeta,Assam,India,781352
71	Ms. JOYASHREE DUTTA	Indian	Female	VILL & P.O- MISSAMORA GAON-785618,GOLAGHAT,ASSAM,Indian,785618
72	Dr. Devendra Singh Parihar	Indian	Male	Lodi (Tanga), Post- Sera, Baya Bansh Bahar, Bangapani, Munsyari, Pithoragarh, Uttarakhand, India-262555.,Pithoragarh,UTTARAKHAND,India,262555
73	Ms. Patel Hani Pradipkumar	Indian	Female	Patel society, nearby Gayatri temple, Langhanaj,Mehsana,Gujarat,India,382730
74	Mr. Julhas Ali	Indian	Male	VILL-JARAMARI PO-BALISATRA PS-DHING DOST-NAGAON STATE-ASSAM,Nagao ,Assam,India,782122
75	Dr. Ganapathy Pattukandan Ganapathy	Indian	Male	No.11.Mari Amman Koil Street, Krishnapuram Gingee,Villupuram,Tamil Nadu,India,632014
76	Ms. Namratha Karey	Indian	Female	9-117 jayprakash nagar, turangi ,Kakinada,Andhra Pradesh,India,533016
77	Mr. MORIYA BHAVESH DHAGLARAM	Indian	Male	K/3/97 NOBLENAGAR , NARODA, ,AHMEDABAD,GUJARAT, Indian,382340
78	Mr. Bidyut Bikash Hazarika	Indian	Male	H.no 29,Chitranan Path bylane 2 Nagarik path near M.P Academy,Kamrup metropolitan ,Assam,India,781040
79	Dr. KALPAJIT HAZARIKA	Indian	Male	MAJULI, ASSAM, 785104,MAJULI,Assam,India,785104
80	Mr. Alaktarag Phukon	Indian	Male	Charigaon, Panchawati,Jorhat,Assam,India,785101
81	Prof.Jahanvi Suthar	India	Female	c-38, Keshavbaug Society, Near Grow more school, Naroda, Ahmedabad, Gujarat, India.,Ahmedabad,Gujarat,India,382330
82	Mr. Krutik Bhupeshkumar Khatri	Indian	Male	B-114 SHANTINIKETAN SOCIETY NEAR RANCHHODJI TEMPLE WAGHODIA ROAD VADODARA. ,Vadodara,Gujarat,India,390019
83	Ms. Patel Jahvi Maheshbhai	Indian	Female	8, Sahjanand Society, Urban Bank Road, Mehsana - 2,Mehsana ,Gujarat ,India ,384002
84	Dr. Anup Kumar Sutar	Indian	Male	Bonaigarh ,Sundargarh,Odisha,India,770038
85	Ms. Dolly Deori	Indian	Female	Cycle Factory Kalapahar Guwahati Assam ,Kamrup metropolitan ,ASSAM,India,781016
86	Mr. Bhaskar Jyoti Dihingia	Indian	Male	Dhemaji ,Dhemaji ,Assam,India,787057
87	Mr. DURGA SAI DORABABU VEGIROUTHU	Indian	Male	zaderu, gangavaram mandal, India, Andhra pradesh,East godavari,AP,India,530017
88	Mr. Bansanham K Khongstia	Indian	Male	Nohwet,East Khasi Hills District,Meghalaya,India,793110
89	Ms. ABHIRAMI R	Indian	Female	CHARUSILA,PERIYAT,MANDUR POST,KANNUR,KERALA,KANNUR,Kerala,India,670501
90	Dr. Lal Dinpuia	Indian	Male	College Veng, Aizawl,Aizawl,Mizoram,India,796001
91	Mr. Anmol Ratna	Indian	Male	Sitamardi, Bihar,Sitamardi,Bihar,India,843316
92	Ms. HIEVINU OLIVIA RICHA	Indian	Female	Jakhama Village Nagaland,Kohima,NAGALAND,India,797001
93	Ms. Anjumoni Chetia	Indian	Female	Barbaruah Tekela Gaon,Borigaon Siding,Jorhat,Assam,India,785001
94	Mr. BASANTA MANGAL KAUSHIK	Indian	Male	SANKARDEV NAGAR JORHAT ASSAM,Jorhat,Assam,Indian,785001
95	Mr. ASTIK SHARMA	Indian	Male	VILL- KABICHANDRAPUR, P.O- TARAPITH, P.S- RAMPURHAT,BIRBHUM,WEST BENGAL,Indian,731244



96	Dr. Dr. Mithila Verma	Indian	Female	New Delhi,Central Delhi,Delhi,India,110003
97	Ms. Bhagwati	Indian	Female	Sunaro ka Bas Baori Jodhpur Rajasthan India,Jodhpur,Rajasthan,India,342037
98	Mr. ANGAD YADAV	Indian	Male	Village Gaura khas PO-jakhanian DIST-ghazipur,Ghazipur,UTTAR PRADESH,India,275203
99	Mr. FIRDUSH ZALLAH HUSSAIN	Indian	Male	SEUNI ALI, JORHAT,ASSAM,Jorhat,Assam,India,785001
100	Ms. JESSICA BORUAH	Indian	Female	1 No. Borkheremia Village,Dibrugarh,Assam,India,786621
101	Mr. Kushwaha Dilip Singh	Indian	Male	A/404, Om Shanti Residency, Opp. sindbad Hotel, Behind Sukan mall, K.I.R.C college road, Kalol,Gandhinagar,Gujarat,India,382721
102	Dr. Dr J L Gautam	Indian	Male	957, Sector-9, Vasundhara,Ghaziabad,UP,India,201012
103	Dr. MANOHAR LAL	Indian	Male	Y II E 391 D TRIVENIPURAM JHUNSI PRYAGRAJ,PRYAGRAJ,UTTAR PRADESH,Indian,211019
104	Mr. Gautam Vishwakarma	Indian	Male	Village Ubarpur Lakshmipur Post Ubarpur ,Azamgarh ,UTTAR PRADESH,India,276202
105	Ms. GARIMA SACHDEVA	Indian	Female	6/1,GENERAL WING,PREMNAGAR,DHRADUN,DEHRADUN,UTTRAKHAND,Indian,248007
106	Dr. Sandeep Gupta	Indian	Male	St. No. 8, Habsiguda, Hyderabad,Hyderabad,Telangana,India,500007
107	Mr. DEEPANSH MISHRA	Indian	Male	Flat No. A-202, Tulip Grand,Bareilly,Uttar Pradesh,India,243003
108	Mr. Ankush	Indian	Male	Narwana,Jind,Haryana,India,126116
109	Mr. Dhiraj Saikia	Indian	Male	Vill : No. 2 Chungajan, P.O : Chungajan, P. S : Chungajan ,Golaghat,Assam,India,785601
110	Dr. Sunil K. Roy	Indian	Male	H. No. 2-17-127/161, Flat. No. 301, Shiva Sai Residency, Sri Raghavendra Nagar,K.V.Rangareddy,Telangana,India,500039
111	Mr. Anirudh A Kumar	Indian	Male	"HAVEN", Cheruvatta, Moozhikkal,Kozhikode,Kerala,India,673012
112	Mr. SESHU GANESH SIVALANKA	Indian	Male	2-195/2, velagadurru, Undrajavaram, East Godavari, Andhra Pradesh, India-534227,EAST GODAVARI ,ANDHRA PRADESH ,Indian,534227
113	Mr. Jnanendra Sarma	India	Male	HN-29A, Kalyani Nagar, Kahilipara, Guwahati,Kamrup Metro,Assam,India,781019
114	Ms. Dorepalli Mary Priyanka	Indian	Female	Dammapeta ,Bhadradi kothagudem ,TELANGANA,India,507306
115	Dr. Anju Agarwal	Indian	Female	503, Osimo, Mahagun Mansion, 1/4 Indirapuram, Ghaziabad, Uttar Pradesh, 201014,Ghaziabad,Uttar Pradesh,India,201014
116	Dr. MEGHALI BARUAH	Indian	Female	TOWKOK TEA ESTATE, P.O TOWKOK, PIN 785695, SIVASAGAR, ASSAM,CHARAIDEO,ASSAM,Indian,785695
117	Ms. Vishnupriya Pradeep	Indian	Female	Ennasseriyl (H) Thadikkadave P.O Kottakkadave Kannur Kerala,India,Kannir,Kerala,India,670581
118	Mr. MUNIRAJU AJITHKUMAR	Indian	Male	Tirupati ,CHITTOOR,AndharPradesh,India,517507
119	Dr. Debashree Dutta	Indian	Female	1B Ramjoy seal lane, post office-Beadon Street ,Kolkata ,West Bengal,India,700006
120	Dr. SAROJ KUMAR MONDAL	Indian	Male	Damodarapur, Maira Tola, Dhanbad- ,Dhanbad,Jharkhand,India,826004
121	Ms. ANGELA KOULI	Angela Kouli	Female	Ratanpur,Dhemaji, Assam ,Dhemaji ,Assam ,India,787057
122	Ms. Boyina RoopalakshmiTulasi	Indian	Female	Dr. no 32-7-31/1 Near marrichettu center, Nathayyapalem, Gajuwaka,Visakhapatnam,Andhra Pradesh,India,530012
123	Mr. ANSHUMAN PANDEY	Indian	Male	OLD H-14 ,KABIR NAGAR COLONY, BHU-CAMPUS ,VARANASI,UTTAR PRADESH,Indian,221005
124	Mr. Rajewar Shubham Kashinath	Indian	Male	At Post Niwgha Tq. Mudkhed Dist. Nanded,Nanded,Maharashtra,India,431806
125	Ms. ANUPAMA M	Indian	Female	PATHIYIL MANA, VELLINEZHI P.O. ,PALAKKD,KERALA,Indian,679504
126	Mr. MANISH KUMAR	Indian	Male	DGCO, GSI, C-II, Pushpa Bhawan, Madangir Road New Delhi-110068,south Delhi,Delhi,India,110068
127	Mr. Abhijit Chakraborty	Indian	Male	Chakraborty path, kumaronichiga, Dibrugarh, assamz p.o.-rajabheta, p s.- barbaruah, pin- 786008,Dibrugarh ,Assam,India,786008



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128	Dr. ABDUL AZEEZ K K	Indian	Male	Kizhakkekara House, Kakkanaad P. O., ,Eranakulam,Kerala,India,682030
129	Dr. Jhuma Biswas	India	Female	Pandav Nagar, Guwahati-781012, Assam, India,Kamrup metro,ASSAM,India,781012
130	Ms. Chaturvedi manshi Rakesh	Indian	Female	Room no 303 dhanlaxmi Ekvira apt adivali kalyan east,Thane ,Maharashtra ,India ,421306
131	Er.Javed Hussain	Indian	Male	Biswanath chariali ,Biswanath ,Assam ,India,784176
132	Mr. Ashish Kumar Gupta	Indian	Male	6th mile Tadong, Gangtok,East,Sikkim,India,737102
133	Mr. NARDEEP NAIN	Indian	Male	V.P.O ANDANA, DIST. SANGRUR, ,SANGRUR,PUNJAB,Indian,148027
134	Ms. Priyanka	Indian	Female	h.no. 250 Dayanand colony model town Karnal (Haryana),karnal,Haryana,India,136119
135	Ms. Manisha Bhati	Indian	Female	H.No.- 411, Sector 15 A,Gautam Buddh Nagar,Uttar Pradesh,India,201301
136	Mr. Pruthul Nitinchandra Patel	Indian	Male	87, Aarti Society, NR swaminarayan temple, Ghatlodia, Ahmedabad ,Ahmedabad,Gujarat,India,380061
137	Dr. ANTARA SHARMA	Indian	Female	D.C.B road ,Jorhat,Jorhat ,ASSAM,India,785001
138	Mr. Abhishek	Indian	Male	,,, ,India,247667
139	Dr. Dr. J. Malsawma	Indian	Male	B-54, Armed Veng South, Aizawl, Mizoram, 796008,Aizawl,Mizoram,India,796008
140	Mr. JINTIRAJ TALUKDAR	Indian	Male	Vill: Gerimari, Mangaldai,Darrang,Assam,India,784125
141	Ms. Mukhlisa Tasrin	Indian	Female	Gar Ali, Jorhat,Jorhat,Assam,India,785001
142	Mr. HIRAK JYOTI RAY PRODHANI	Indian	Male	Ward No:5,Sankardev Road,PO+Ps:Golakganj, Dist:Dhubri,State:Assam,PIN:783334,Dhubri,Assam,India,78 3334
143	Ms. Nidhi Singh	Indian	Female	Barpathar Town,Golaghat,Assam,India,785602
144	Ms. Anaya Tiwari	Indian	Female	70 A Deepak Nagar Sagar Royal Vikas Hoshangabad Road Bhopal ,Bhopal ,Madhya Pradesh ,India ,462026
145	Dr. Shantanu Pandey	India	Male	S. G. R.C., Wilton Hall Estate, 3 & 1/2 Mile, Upper Shillong,East Khasi Hills,Meghalaya,India,793005
146	Ms. Shraddha Deori	Indian	Female	C-30, Near Dispensary, ONGC Colony Nazira,Sivasagar,Assam,India,785685
147	Ms. Km Preeti	Indian	Female	Gayatri Nagar naubasta sitapur road Lucknow ,Lucknow ,UTTAR PRADESH,India,226021
148	Mr. SHOVANJIT PAL	Indian	Male	At- Odagaon,Nayagarh,Odisha,India,752081
149	Mr. Suraj Singha	Indian	Male	Vill- Mazargool, P.O- Anglar Bazar,Karimganj ,Assam,India,788806
150	Dr. Dr. Smritimala Sarmah	Indian	Female	Ulubari, Guwahati,Kamrup Metro,Assam,India,781007
151	Mr. Pronoy Protim Dutta	Indian	Male	Charigaon, Sonarigaon,Jorhat,Assam,India,785101
152	Dr. Dasari Mysaiah	Indian	Male	H No. 5-48, Juloor(Vill&Post), Bhoodan Pochampally (Mdl),Yadadri-Bhuvanagiri ,Telangana,India,508284
153	Ms. Runjun Boruah	Indian	Female	Dhakuakhana,Lakhimpur,ASSAM,India,787055
154	Dr. KOLIPAKA VENU	Indian	Male	OSMANIA UNIVERSITY, HYDERABAD,HYDERABAD,TELANGANA STATE,Indian,500007
155	Ms. Shilpi sikha Das	Indian	Female	Purani Bongaigaon, Bhatipara, Pt-1, Bongaigaon,Bongaigaon,Assam,India,783380
156	Mr. Sushrat Mishra	Indian	Male	AT/PO-Lekhanpur, PS- Salipur, VIA-RAMESWAR, PIN- 754201,Cuttack,Odisha,India,754201
157	Mr. AYUSH RAWAT	Indian	Male	103 Garh Vihar Phase-2 PO IIP Mohkampur Dehradun ,Dehradun ,Uttarakhand ,Indian,248005
158	Mr. Mrigendra Narayan Barman	Indian	Male	Dibrugarh,Dibrugarh,Assam,India,786003
159	Mr. RISHI KUMAR	Indian	Male	Village - Bawania,Mahendergarh ,Haryana,India,123034
160	Mr. Robin Jebakumar F	Indian	Male	3/117 Sawyerpuram, Thoothukudi Tamilnadu 628 251.,Thoothukudi,Tamilnadu,India,628 251
161	Mr. Rishu Pandey	Indian	Male	Vill Machhariha Pandey Purva Shivrampur, Chitrakoot,Chitrakoot,Uttar Pradesh,India ,210205
162	Ms. Satabdi Baruah	Indian	Female	Ratanpur, Dhemaji,Dhemaji ,Assam,India,787057
163	Mr. ASWIN SURESH	Indian	Male	Keloth House, vadasseri, mathil PO, payyanur, kannur, Kerala, 670307,Kannur ,Kerala,India,670307
164	Dr. S.Muthusamy	Indian	Male	V.O.Chidambaram College,Thoothukudi,Tamilnadu,India,628008
165	Mr. Rupjoy Maibangsa	Indian	Male	Vill-Kharnaidisa, Dhansiri, Karbi Anglong, Assam,Karbi Anglong ,Assam ,India,782470



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166	Mr. Mr. Vickey Sharma	Indian	Male	V.P.O JAKHBAR ,KATHUA,J&K,Indian,184104
167	Ms. Sushmita Das	Indian	Female	New Guwahati Tinali Noonmati,Kamrup Metro,Assam,India,781020
168	Mr. Pawan Maurya	Indian	Male	Nizampur, Saripur, S.R.N. Bhadohi, 221314,S.R.N. (Bhadohi),Uttar Pradesh,India,221314
169	Mr. SURAJIT NATH	Indian	Male	VILLAGE NAM DOOM DOOMIA SATRA,NAGAON,Assam (AS),Indian,782123
170	Mr. Nitish Kumar Sarma	Indian	Male	Gauhati ,Kamrup m,Assam,India ,781001
171	Mr. Shashank Shekhar Mahapatra	India	Male	Plot no.2024/8872, Kishan Nagar, near Satya Vihar, Rasulgarh, Bhubaneswar ,Khordha,Odisha,India,751010
172	Mr. PRASENJIT PAUL	Indian	Male	K P ROAD ,DIBRUGARH,ASSAM,India,786001
173	Mr. Saptadeep Nandi	Indian	Male	Nayapara, Pragati road anjali biswas sarani , Dharmanagar 799250, North Tripura, TRIPURA, India, 799250
174	Mr. SABIRUL SK	Indian	Male	KHARIBONA, RAGHUNATHGANJ, MURSHIDABAD, WEST BENGAL, 742225, MURSHIDABAD, WEST BENGAL, Indian, 742225
175				
176	Ms. Sohini Neogy	Indian	Female	43/2 Kamini School Lane Salkia Howrah - 711106 ,Howrah ,West Bengal ,India,711106
177	Ms. ROWSNI DUWARAH	Indian	Female	Bhakat Bhajani Gaon Lakwa , Sivasagar Assam,Sivasagar,Assam,India,785698
178	Mr. Chandan Dey	Indian	Male	Sonari, Charaideo, Assam, India, 785690
179	Ms. MAYURI SARMA	Indian	Female	Vil-Bardhanara, po- Dakshingaon, Ps- Ghograpar, Pin- 781350, Nalbari, Assam, Nalbari , Assam, India, 781350
180	Mr. Sanampudi Venkata Rami Reddy	Indian	Male	Mutyalampadu ,Guntur ,Andhra Pradesh ,India,522414
181	Ms. OLIVIA SARKAR	Indian	Female	D.B.C ROAD, DESHBANDHU PARA, SILIGURI, DARJEELING, WEST BENGAL, Indian, 734004
182	Ms. Seema Gogoi	Indian	Female	Near weekly market bihubar Sivasagar, Assam,Sivasagar,Assam,India,785687
183	Mr. SAISIDDHANT MOHARANA	Indian	Male	at - Sarol ,Jagatsinghpur ,odisha,India,754136
184	Ms. RESHMI DAS T D	Indian	Female	Thuzhithara (H), Pai Road, Peeimpadappu, Palluruthy, Kochi, Ernakulam, Kerala, India, 682006
185	Mr. Shivam Garg	Indian	Male	Assandh ,Karnal ,Haryana ,India ,132039
186	Mr. Arshad Ahmed	Indian	Male	Village dharana teshil mendhar district poonch Jammu and Kashmir ,Poonch ,Jammu and Kashmir ,India,185211
187	Ms. Meenakshi Boro	Indian	Female	Sajjanpara, Rani, Guwahati, Assam, Kamrup, Guwahati, India, 781015
188	Mr. ARUP ROY	Indian	Male	Puthimari ,Nagaon ,ASSAM,India,782426
189	Ms. Nabajeeta Chakraborty	Indian	Female	Byelane no.1, house no.5, Pragjyotish Nagar, B.G.Colony, Guwahati 11, Kamrup (metropolitan), Assam, India, 781011
190	Mr. SHARIFUL ISLAM	India	Male	HN 598, Bhowkamari, Kayakuchi, Barpeta ,Assam,India,781352
191	Ms. RUOKUONUO RUPRE-O	Indian	Female	CHIECHAMA VILLAGE, KOHIMA NAGALAND, HCOHIMA, NAGALAND, India, 797001
192	Mr. Sahid Afridi Hossain	Indian	Male	Vill- Kokil, P.O.- Daulatpur, P.S.- Harirampur, Dist- South Dinajpur, State- West Bengal, Pin- 733125, ,South Dinajpur, West Bengal, India, 733125
193	Mr. Trideep Saikia	Indian	Male	Vill. - Barangabari, PO- Barangabari, Pin- 784522, Darrang, Assam, India, 784522
194	Mr. Rahul Vishwakarma	Indian	Male	Village- Hathiwar, Post- Ramapur Varanasi ,Varanasi ,Uttar Pradesh ,India,221204
195	Mr. PYLA SAIRAM ADITYA	Indian	Male	D no-38-30-246/4, Green Gardens, Marripalem, Visakhapatnam ,Visakhapatnam ,Andhra Pradesh ,India ,530018
196	Mr. SUDARSHAN KAKATI	Indian	Male	Vill Jatiabhangara, po loch, PS baihata chariali, Kamrup, Assam, India ,781381
197	Mr. GOWTHAM A	Indian	Male	156 kurambar street , Thirumanur, Salem, Tamil Nadu, India, 636202
198	Ms. Progati Dev	Indian	Female	Kokrajhar Ward No. 9, P.O.- Kokrajhar ,Kokrajhar ,Assam,India,783370
199	Mr. SUDIPTA ADHIKARY	Indian	Male	VILL- SOUTH CHANDAMARI, POS - CHANDAMARI, PS - KALYANI ,NADIA ,WEST BENGAL, Indian ,741245
200	Ms. Smaraki Sundarray	Indian	Female	At/Po - Chhenapadi, PS - Nandipada, Block - Hatadihi, Keonjhar ,Odisha ,India ,758083
201	Mr. SAI RAMAN PATRA	Indian	Male	Near AXIS Bank ATM, Main Road, Gopalpur, Nayagarh, Odisha, India, 752025



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202	Ms. D.SHANBAGAPRIYA	Indian	Female	No 189 Kamaraj Street Tiruvur,Thiruvallur,Tamilnadu,India,602025
203	Ms. ANUSKA BARUAH	Indian	Female	Pulibor kalyanpur Jorhat 785006,Jorhat,Assam,India,785006
204	Ms. Shrishti Singh	Indian	Female	N/Sub R.K Singh, shiv colony loco road maseni, Fatehgarh Farrukhabad U.P,Farrukhabad ,Uttar Pradesh,India,209601
205	Er.Pranati Mandal	Indian	Female	Vill - Dongibil,,North Lakhimpur ,Assam,India,784161
206	Ms. PRANSHU	Indian	Female	#5358/45, SHAHEED BHAGAT SINGH NAGAR, ROPAR,ROOPNAGAR,PUNJAB,Indian,140001
207	Ms. Sonia Devi	Indian	Female	#1219D, Near Taj Mohamad Hospital, Bhuna Road, Tohana- 125120,Fatehabad,Haryana,India,125120
208	Mr. LALRUATPUIA TLAU	Indian	Male	H/226,Thingsulthliah,Aizawl,Mizoram,India,796161
209	Mr. Bibhuti Bhusan Hota	Indian	Male	Rrit colony qno - L/46 , near govt college sundargarh , rangadhipa post office , pin - 770002,Sundargarh,Odisha,India,770002
210	Mr. YADAV KRISHNA GOGOI	Indian	Male	BORPATHAR DIGHALA GAON, NEAR BORPATHAR BOYS HIGH SCHOOL, PO- RAJABHETTA PS- BORBORUAH DIST- DIBRUGARH STATE- ASSAM PIN- 786008,DIBRUGARH,ASSAM,Indian,786008
211	Mr. Mohd Shahabuddin	Indian	Male	Village Kamruddinpur Post Prithvipur Pin 222203,Jaunpur,Uttar Pradesh,India,222203
212	Mr. Lallawmsanga	Indian	Male	C-83, Zonuam,Aizawl,Mizoram,India,796009
213	Ms. POOJA PRADEEP	Indian	Female	Retnavilas, Eravimangalam P. O, Kottayam, Kerala ,Kottayam ,KERALA,India,686613
214	Ms. MADHURIMA PURKAIT	Indian	Female	Arobindanagar, Sonarpur , Kolkata+700150,South 24 Paragana ,WEST BENGAL,India,700150
215	Mr. SOROKHAIBAM CHANDRABOSH MEITEI	Indian	Male	Wangjing Lamding cherapur ,Thoubal,Manipur ,India,795148
216	Dr. Rubi Chakraborty	Indian	Female	B 001, Hesarghatta Rd, Near UCO Bank, Rangappa Layout, Mallasandra, Jalahalli West, Bengaluru, Karnataka ,Banglore,Karnataka,India,560057
217	Ms. Sayali Ajay Dongarwar	Indian	Female	48, Sai nagar ,Subhash ward wani road warora.,Chandrapur ,Maharashtra ,India,442907
218	Mr. DIPANKAR DEBNATH	Indian	Male	BIHARA BAZAR, HATIMARA ROAD H/N 207, P.S. KATIGORAH, 788817.,CACHAR,ASSAM,India,788817
219	Mr. Vinay Raikwar	Indian	Male	Near Gram Panchayat office Rajakhedi Makronia Sagar (M.P),Sagar,Madhya Pradesh,India,470004
220	Mr. SAURAV NANDI	Indian	Male	Vill-Chungapota, Paschimpara, Near Manasha Mandir, New Bongaigaon,Bongaigaon ,Assam,India,783381
221	Ms. TULIKA RANI BORUAH	India	Female	Bajalkata, Borholla,Jorhat,ASSAM,India,785631
222	Mr. AKHIL P	Indian	Male	BALANILAYAM,KANDIYOOR,THATTARAMBALAM P.O,MAVELIKARA,ALAPPUZHA,KERALA,India,690103
223	Mr. Goswami Keyurgiri Rajendragiri	Indian	Male	Ambika chowk, itadara,Gandhinagar,Gujarat,India,382845
224	Ms. Dibyashree Mahapatra	Indian	Female	63/B, Kalighat Road, Kolkata - 700026,Kolkata ,West Bengal ,India,700026
225	Mr. Nishant Kumar	Indian	Male	Delhi,New Delhi,New Delhi,India,110017
226	Ms. P. SILVIA	Indian	Female	24 SSK Nagar Kanchipuram,Kanchipuram,Tamilnadu,India,631502
227	Mr. AJEET KUMAR	Indian	Male	645B/46 ABHISHEKPURAM COLONY JANKIPURAM EXTENSION LUCKNOW,LUCKNOW,UTTAR PRADESH,Indian,226021
228	Mr. Kaushik Biswas	Indian	Male	Kang Kan Nagar, Sivasagar, Assam,Sivasagar,Assam,India,785640
229	Mr. Yehya Rasool	Indian	Male	Zazna Wakura Ganderbal,Ganderbal,Jammu and Kashmir,India,191131
230	Ms. Persona Gogoi	India	Female	Boragadhoi village, Duliajan,Dibrugarh,Assam,India,786004
231	Mr. Ashish Halder	Indian	Male	223, prince tailors, market, Shaktifarm ,Udham singh nagar ,Uttarakhand,India,263151
232	Dr. SUBRATA CHATTERJEE	Indian	Male	VILLAGE PATHURIA ,DIST BOKARO ,BOKARO ,JHARKHAND ,Indian ,829301
233	Ms. Aayushi Kedia	Indian	Female	B27/98C Durgakund road,Varanasi ,Uttar Pradesh,India,221005
234	Mr. Mohd Zeeshan Khan	Indian	Male	Vill and Post Shivtara,Ambedkar Nagar ,Uttar Pradesh,India,224129
235	Mr. Tapaswi Saikia	Indian	Male	Silapathar Bamgoan Dhemaji Assam,Dhemaji,ASSAM,India,787059



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236	Ms. MACHITTI PAVANI	Indian	Female	11-45, Srinivasa colony, srungavarapukota,Vizianagaram ,Andhra Pradesh ,India ,535145
237	Dr. Paragjyoti Chutia	Indian	Male	Dept. Of Physics, DHSK College,Dibrugarh,Assam,India,786001
238	Ms. GAYATRI KALITA	Indian	Female	Sonaighuli near Don Bosco School Lohra; Guwahati ,Kamrup Metropolitan ,Assam,India,781034
239	Ms. Suryapriya S	Indian	Female	Suresh bhavan,pulloorkunnu,aroor,ponganadu(PO),Thiruvanantha puram,KERALA,India,695601
240	Mr. HANSU K SHARMA	Indian	Male	VILL-SHYAMSINGHPURA POST-DWARPURA TEH-BASWA ,DAUSA,RAJASTHAN,Indian,303314
241	Mr. Khushal Satish Sakharkar	Indian	Male	Vidhya Nagar Ward, Panchashil chowk, Ballarpur,Chandrapur ,Maharashtra ,India,442701
242	Ms. Roshni Agarwal	Indian	Female	Station Chariali ,Sivasagar,Assam,India,785640
243	Ms. Nisha Pujari	Indian	Female	Flat no 301 Guru Mishri Arcade near Mahavir Bhavan Kumbharvada Aurangabad ,Aurangabad ,Maharashtra ,India,431001
244	Dr. Ravi Kumar Muppidi	Indian	Male	csir-ngri,Main building,Medchel,Telangana,India,500007
245	Mr. SAI DINESH M	Indian	Male	ward no. 11, vidyanagar, gangavathi Karantaka.,koppal,karnataka ,Indian,583227
246	Dr. Dr. SHIVANNA S	Indian	Male	DEPARTMENT OF CIVIL ENGINEERING , SIR M VISVESVARAYA INSTITUTE OF TECHNOLOGY, BANGALORE - 562 157,BNAGALORE,Karnataka,India,562 157
247	Er.Snigdha Kalita	Indian	Female	Bezera-781121,Kamrup ,Assam,India,781121
248	Dr. KUNAL MODAK	Indian	Male	Deshbandhu Road, S.C.Sarani,,Districts,West Bengal,India,723101
249	Dr. POMPI SARKAR	Indian	Female	2No. Jyoti Nagar Coloni, Ward 4, Siliguri-734005,Darjeeling,WEST BENGAL,India,734005
250	Dr. N.K.NARAYANASWAMY	Indian	Male	2201, 5TH CROSS, 2ND STAGE, HAL, BANAGALORE,BANAGALORE,KARNATAKA,Indian,560036
251	Ms. Anubrata Bordoloi	Indian	Female	Na- Ali Dhekiajuli South Sonari Goan, Jorhat,Assam ,Jorhat ,Assam ,India ,785009
252	Mr. Mafidul Islam	Indian	Male	Vill/PO ADABARI PS MUKALMUA DIST NALBARI PIN 781126,Nalbari,Assam,India,781126
253	Ms. Shikha Sharma	Indian	Female	Lal Quarters, Ghaziabad (U.P) 201002,Ghaziabad,Uttar Pradesh,India,382424
254	Dr. Ghanashyam Deka	Indian	Male	2 No. Nathkuchi,Nalbari ,Assam ,India ,781355
255	Dr. Ranjana Ramdas Gawande	Indian	Female	Flat No. 09 "Sailabh Enclave", Itkheda, Paithan Road, Aurangabad.,Aurangabad,Maharashtra,India,431-005
256	Mr. RAJKUMAR	Indian	Male	VPO -AHROD, DISTT AND TEHSIL - REWARI,REWARI,HARYANA,Indian,123102
257	Mr. Baichitra Chandra Borah	Indian	Male	Pachim Bongal Pukhuri, bye lane 4, jorhat,Jorhat,Assam,India,785001
258	Mr. Dwijendra Nath Pandey	Indian	Male	VILL Gulahriya PS Khesraha Bansi,Siddhartha Nagar,Uttar Pradesh,India,272154
259	Mr. Mohammed Arafath.M	India	Male	S/o Mohammed Yousef,Kadamkurussi,Pothampadam,Muthalamada(po)678 507,Palakkad,Kerala,India,678507
260	Mr. Rajana Siddhardha	Indian	Male	STPM Colony, 200L, Vijayawada,Krishna,AP,India,520011
261	Ms. Layana Vijayan	Indian	Female	Devinilayam po Kolachery Kannur Kerala,Kannur,Kerala,India,670601
262	Mr. Prabhu S	Indian	Male	121, Samayapuram, Poonthamalli Nagar,,Trichy,Tamil Nadu,India,621112
263	Mr. Manabendra Challeng	Indian	Male	Borghuguloni Village P.O. Rangchali,Dibrugarh,Assam,India,785675
264	Ms. RASHMI BORGHAIN	Indian	Female	GELAKEY DAGAON,SIVASAGAR,ASSAM,Indian,785696
265	Mr. Vivekanand	Indian	Male	Hanuman Nagar, Rosera, Bharwadi,Samastipur,BIHAR,India,848208
266	Ms. Antara Banerjee	Indian	Female	Qtr. A11/302 Games Village, Lalmati ,Guwahati-781029 Assam ,Kamrup Metro,Assam,India,781029
267	Mr. Pallab Dey	Indian	Male	147, B/22, Girish Ghosh Road, Belurmath, Howrah-711202,Howrah,West Bengal,India,711202
268	Mr. GAURAV KUMAR	India	Male	vill & Post Daheli,Aligarh,Uttar Pradesh,India,202126
269	Ms. Niketa Dayma	Indian	Female	Godawari villa, choursiyawas road, dwarka nagar, gali no 3, vaishali nagar, Ajmer (Raj.),Ajmer,RAJASTHAN,India,305001
270	Ms. Akangshya Goswami	Indian	Female	Janapith, Malow Ali, Jorhat,Jorhat,Assam,India,785001



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271	Mr. SANJAY KUMAR VERMA	Indian	Male	Village and Post - Jagadishpur, Phoolpur, AZAMGARH, Uttar Pradesh, Indian, 276304
272	Mr. Lutte Sudhakar Balaji	Indian	Male	School of Earth Sciences, S.R.T.M. University Nanded Maharashtra 431606, Nanded, Maharashtra, India, 431708
273	Mr. Rohan Roy	Indian	Male	IIT KHARAGPUR, WEST MIDNAPORE, West midnapore, West Bengal, India, 721302
274	Ms. Mouchumi Boruah	Indian	Female	Seujpur PO Gogamukh Dhemaji Assam- 787034, Dhemaji, Assam, India, 787034
275	Mr. M IMOBA SINGHA	Indian	Male	silchar, cachar, assam, Indian, 788001
276	Dr. Saheli Chowdhury	Indian	Female	5/B/1/C, Sahid Khudiram Bose Road, Budge Budge, 24 Parganas South, West Bengal, India, 700137
277	Mr. PRIYAM JYOTI BORA	Indian	Male	BORA CHUCK TARAJAN JORHAT, JORHAT, ASSAM, Indian, 785001
278	Mr. Musfiqur Rahman	Indian	Male	Village: Barpaka, PO: Tarabari, Pin: 782125, Nagaon, Assam, India, 782125
279	Mr. TH SHYAMAL SINGHA	Indian	Male	Silchar, Rongpur, Cachar, Assam, India, 788009
280	Mr. Patel Sandeepkumar Z.	Indian	Male	D-404, Shree Swaminarayan niketan flats, opp. To Tulsi heights, Bapod, Vadodara., Gujarat, GUJARAT, India, 390019
281	Mr. Ratul Mukherjee	Indian	Male	Vill+P.O.+P.S.= Illambazar; Dist- Birbhum; Pin-731214; State- West Bengal, Birbhum, West Bengal, India, 731214
282	Ms. Rupali Ratnakar Kochrekar	India	Female	Kholpewadi Sal Bicholim Goa, North, Goa, India, 403503
283	Mr. GYANDEEP DEOGHARIA	Indian	Male	KHANIKAR GAON, SIMALUGURI, SIVASAGAR, ASSAM, Indian, 785685
284	Ms. Hirumoni Hazarika	Indian	Female	No 3 kakopathar, Tinsukia, Assam, India, 786152
285	Mr. PRITOM PRAN DUTTA	Indian	Male	KARANGA BHOKAT CHEUNI GAON, P.O. - KARANGA, JORHAT, ASSAM, Indian, 785008
286	Mr. S.JANARDAN	Hindu	Male	Pudhu nallagoundam Patti nallagoundam Patti omalur Salem 636304, Salem, Tamilnadu, India, 636304
287	Mr. Akshay Raj Manocha	Indian	Male	HL- 407, phase-9, mohali, Sector- 63 SAS Nagar, Sas Nagar, Punjab, India, 160062
288	Mr. Chaitanya Popli	Indian	Male	35 Arjun Nagar, Ambala, Haryana, India, 133001
289	Mr. PARMAR MAHENDRA RAMBHAI	Indian	Male	Akota, Vadodara, Gujarat, Vadodara, Gujarat, India, 390020
290	Ms. Priyadarshini S	Indian	Female	No, 56 MN Nagar Kolathur, Chennai, Tamil Nadu, India, 600099
291	Ms. Sonali Devi	Indian	Female	Nai Basti District Reasi, Jammu and Kashmir, Reasi, Jammu and Kashmir, India, 182311
292	Mr. Preetam Kumar Adhikari	Indian	Male	H.no. 36, Bani path, bhetapara, guwahati 781028, Kamrup M, Assam, India, 781028
293	Mr. Mrinmoy Tamuli	Indian	Male	Vill/P.O - Totoya, Majuli, Assam, 785106, Majuli, Assam, India, 785106
294	Mr. BEDANTO CHUTIA	Indian	Male	HATICHUNGI KAMAR GAON, JORHAT, ASSAM, JORHAT, ASSAM, Indian, 785008
295	Ms. GARIMA KONWAR	Indian	Female	BAMGAON, OPPOSITE 30 BEDDED MODEL HOSPITAL, SILAPATHAR, DHEMAJI, ASSAM, Indian, 787059
296	Mr. Abhilash Gayan	Indian	Male	Raidongia gaon, P. O. Amguri, sivasagar, Sivasagar, ASSAM, India, 785680
297	Ms. Rajeswari S	Indian	Female	293, Viveaganandha street, Tirur, Tiruvallur, Tiruvallur, TAMIL NADU, India, 602025
298	Dr. Nibedita Dutta	Indian	Female	Temple Lane, Kalibari Road, Lumding, Hojai, Assam, India, 782447
299	Dr. C.Zoramthara	Indian	Male	Kaisara Road, Tuikual South, Aizawl, Mizoram, India, 796001
300	Ms. BORNALI BORA	Indian	Female	Gohain Tekela Gaon, P.S: Bhogdoi, P.O: Changeli Gaon, PIN: 785010, Jorhat, Assam, India, 785010
301	Ms. RAJALAKSHMI K V	Indian	Female	Kandathil House, Lakshmi Nagar, Kanhangad, Kasaragod, Kasaragod, Kerala, India, 671315
302	Mr. Md.Mujahed Baba	Indian	Male	H.No. 10-40/A/1, Hanumannagar, Husnabad, Siddipet, Telangan-505467, Siddipet, Telangana, India, 505467
303	Ms. Aswathy S	Indian	Female	Manacaud PO, Thiruvananthapuram, Kerala, India, Thiruvananthapuram, Kerala, India, 695009
304	Ms. ANAGHA V	Indian	Female	VARAPPURATH (H) CHATHAMANGALAM (PO) KOOZHAKODE, KOZHICODE, KERALA, Indian, 673601
305	Mr. Jitheesh Krishnan K V	Indian	Male	Mechappara House, Kalliot, Kanhiradukkam P O, Periya, Kasaragod, Kerala, 671531, Kasaragod, Kerala, India, 671531
306	Mr. T Ngamlengin Haokip	Indian	Male	Leijangkhopi village, Churachandpur, Manipur, Churachandpur, Manipur, India, 788011
307	Ms. Priya Singh	Indian	Female	1818/39, Jood Bagh, Tri Nagar, New Delhi- 110035, North West Delhi, New Delhi, India, 110035



308	Ms. Dipsikha Saikia	Indian	Female	Lokhowjan, Bokakhat P.o- Lokhowjan PIN-785612,Golaghat,Assam,India,785612
309	Ms. BORSHA DUTTA	Indian	Female	Charigaon, Jorhat. ,Jorhat,Assam,India,785101
310	Ms. Rose Mary Shaju	India	Female	Thanangattu (H),Angadikadavu P.O,Kannur,Kerala,India,670706
311	Mr. Sahil Singh	Indian	Male	Gaura kashipur 221311,Varanasi,Uttar Pradesh,India,221311
312	Mr. Manik Lakherwal	Indian	Male	Vill. telpur, vikasnagar , dehradun utrakhand,Dehradun,Uttarakhand,India,248198
313	Ms. Ramya Jeyaraman	Indian	Female	Plot no. 250, 7th Cross,Gokula Nagar,Kattur,Trichy ,Trichy,Tamilnadu,India,620019
314	Mr. SENTHIL KUMAR M	Indian	Male	4/277, Suckan Medu, Nanthavanapatty,Dindigul,Tamil Nadu,India,624005
315	Ms. Anu Joseph	Indian	Female	Urumpil House,Pangada P.O,Pampady,Kottayam,Kerala,India,686502
316	Mr. Kamlesh Goswami	Indian	Male	Vill. Rampur P.o. Pandrola ,Rudraprayag ,Uttarakhand ,India,246475
317	Mr. ATUL SAINI	Indian	Male	HOUSE NO 694, KRISHNA COLONY, MILK ROAD, NARAINGARH,AMBALA,HARYANA,Indian,134203
318	Ms. Parinita Rajbongshi	Indian	Female	South Hazarapara, Tezpur Assam ,Sonitpur ,Assam,India,784001
319	Ms. Aarya Khaire	Indian	Female	Pramod Niwas, Gawde Bhoire Lane, Chinchwadgown, Pune,Haveli,Maharashtra ,India,411033
320	Ms. Kaushiki Pujari	Indian	Female	Dergaon Town ward no. 3 ,near gelabil river side,PIN:785614,P.O:Dergaon, P.S :Dergaon, District: Golaghat ,Golaghat ,Assam ,India,785614
321	Mr. OM PRAKASH KAPTAN	Indian	Male	BHALAYA ROAD, PURANA BHATTHA, NEAR PULIYA, CHANDMARI,MAU,UTTAR PRADESH,India,275101
322	Dr. RAJIV KUMAR	Indian	Male	HNO439 WARD 4 NEAR CIVIL HOSPITAL TARAORI KARNAL HARYANA,KARNAL,HARYANA,Indian,132116
323	Mr. Dhiraj Kumar Singh	Indian	Male	Makdumpur, chhabilapur, Biharsharif ,Nalanda,Bihar ,India,803101
324	Mr. Aakash Chaudhary	Indian	Male	RANJANA BHAWAN, BANDAN TOLA, WARD NO-6, BACHHRAWAN- 229301,RAEBARELI,UTTAR PRADESH,Indian,229301
325	Himangshu Paul	Indian	Male	Uppal,Hyderabad,Telangana,India,500039
326	Ms. NANDINI SHARMA	Indian	Female	H.no 357/ 11, Purana Bazar,MANDI,HIMACHAL PRADESH,Indian,175019
327	Ms. SASHIKOKLA JAMIR	Indian	Female	House no.177 Below PWD office Tongdentsuyong ward Mokokchung Nagaland,Mokokchung,Nagaland,India,798601
328	Mr. Ajmal S	Indian	Male	FATHIMA MANZIL, KAMBATHCHALLA , MUTHALAMADA(POST),PALAKKAD, Kerala,India,678507
329	Mr. Hisham Mohamed	Indian	Male	17, Abdul Rahman Street , Keeranur,Pudukkottai,Tamil Nadu,India,622502
330	Mr. Tanmay Singh	Indian	Male	1374-laxman Puri colony ,Barabanki ,Uttar Pradesh ,India,225001
331	Mr. BHAGYA PRATIM TALUKDAR	Indian	Male	HOUSE NO 65, NARESWAR RAJBONSHI PATH, GREEN VIEW COLONY, NEAR EXCEL CARE HOSPITAL, TETELIYA, KAMRUP(M), ASSAM, GUWAHATI-781011,KAMRUP METROPOLITAN,ASSAM,Indian,781011
332	Dr. R. Lianggenga	Indian	Male	Champhai,Champhai,Mizoram,India,796321
333	Mr. Akash Nair	Indian	Male	D-116, DDA Flats, Kalkaji, New Delhi - 110019, South East Delhi,National Capital Territory of Delhi,India,110019
334	Dr A. A. JAYARAJ	Indian	Male	4-16-48/6, BHARAT PET 4TH LANE , GUNTUR,Guntur,Andhra Pradesh,India,532001
335	Ms. Bhumika Hazarika	Hindu	Female	Biswanath chariali ,Biswanath ,Assam,India,784176
336	Dr. Prasamita Sarkar	Indian	Female	Bir Chandra Nagar,SouthTripura,Tripura,India,799125
337	Mr. Chavan Yuvraj Gorakanath	Indian	Male	Poundul tel. Shirur ,Beed,Maharashtra ,India,414205
338	Mr. LANGSUANPAO SELDOU	Indian	Male	Langol Laimanai,Imphal West,Manipur,India,795004
339	Mr. Patel Govindchandra Kanubhai	Indian	Male	D-28,Astha Aalok, B/H Aarush icon flats,Radhanpur road, Mahesana-384002,Mahesana ,Gujarat ,India ,384002
340	Mr. Darshan Borgohain	Indian	Male	3 No. Nabhakatia, Rajgarh, PIN:786611, P.O: Rajgarh, P.S: Tingkhong,Dibrugarh,Assam,India,786611



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341	Mr. Sarath kumar D	Indian	Male	53, Sowrastra 1st street, Illuppur. ,Pudukkottai,Tamil Nadu,India,622102
342	Mr. Swanand Ajaonkar	Indian	Male	s-2, Shri guru apartment, angol road, tilakwadi, belgaum, Karnataka 590006,Belgaum,Karnataka,India,590006
343	Dr. Ajayakumar P	Indian	Male	Mudiyil Thakkathil House, Adinadu south, Kattilkadavu P.O, Karunagappally, Kollam, Kerala-690542,Kollam,Kerala,Indian,690542
344	Ms. Swati Chakraborty	Indian	Female	B-6A/4 , ARRAH KALINAGAR , DURGAPUR,PASCHIM BARDHAMAN,WEST BENGAL,Indian,713212
345	Mr. NETRAJIT GOGOI	Indian	Male	Silghat, P.O Silghat, P.S Kaliabor ,Nagaon,Assam,India,782143
346	Ms. NIKETA DAYMA	Indian	Female	Godawari villa , Vaishali nagar Choursiyawas road Dwarka nagar gali no 3, Ajmer Raj ,Ajmer,Rajasthan ,India,305001
347	Ms. Jamini Boruah	Indian	Female	Vill Kachuwani Gaon, PO Gobindapur,Lakhimpur,Assam,India,787055
348	Mr. Shajidul Karim	Indian	Male	Assam,South Salmara Mankachar ,Assam,India,783131
349	Ms. Ishika Aggarwal	Indian	Female	Mill market sakoti ,Meerut,Uttar Pradesh,India,250223
350	Mr. Saideep Patnaik	India	Male	Shivanand Nagar sec-3, khamtarai , Raipur, Chhattisgarh, pin 492008,Raipur,Chhattisgarh,India,492008
351	Ms. Gunda Swathi	Indian	Female	Dr. B. R. Ambedkar University ,Srikakulam ,Andhra Pradesh ,India,532410
352	Ms. Dristi Bharali	Indian	Female	Ward No.8, College road, North Lakhimpur Town, North Lakhimpur, Assam ,Lakhimpur ,Assam,India,787001
353	Ms. ANJANA S	Indian	Female	Kalathil,CMC XI ,Cherthala, Alappuzha ,Alappuzha ,Kerala,India,688526
354	Dr. Dr. Niva Rani Devi	Indian	Female	Vill. Larama, PO-Sanekuchi, Dist Nalbari, Assam,Nalbari,Assam,India,781350
355	Dr. neha kumari	Indian	Female	108 brijvatika, Jagatpura ,Jaipur ,Rajasthan ,India,302017
356	Dr. Sarda Maibam	Indian	Female	Heirol Part II Bazaar Maning,Thoubal,Manipur,India,795148
357	Ms. GANGMEI GAICHUNGLU	Indian	Female	Ragailong, near catholic church,imphal east,Manipur,India,795005
358	Mr. Kasangai Panmei	Indian	Male	Tarung Thangmeiband ,Imphal West ,Manipur,India,795004
359	Ms. Laishram Pinky Devi	Indian	Female	Keirak Leirak Achouba, wabagai, kakching district, Manipur ,Kakching ,Manipur ,India,795103
360	Mr. Chingangbam Alison Meitei	Indian	Male	Thoubal Kiyam Siphai ,Thoubal,Manipur ,India,795138
361	Mr. Khangembam Laksana Singh	Indian	Male	Kumbi Thana Leikai, Ward No. 9,Bishnupur ,MANIPUR,India,795133
362	Ms. Hiihveinai D	Indian	Female	Purul Akutpa,Senapati,Manipur,India,795015
363	Mr. PAOMINLUN GUIE	Indian	Male	LOWER KHENGJANG VILLAGE ,KANGPOKPI ,MANIPUR ,Indian,795107
364	Ms. Nitumoni Deori	Indian	Female	Aadiram Borua Path, Gohain Chuck, Sivasagar, Assam,Sivasagar,Assam,India,785640
365	Mr. Nayanmoni kalita	Indian	Male	Palasbari, w/n-08, P.O- Palasbari ,Kamrup,Assam,Indian,781128
366	Ms. Leishangthem Premila Devi	Indian	Female	Tekcham Laibung Leikai ,Thoubal ,Manipur ,India,795148
367	Mr. Laiphrakpam Indiver Singh	Indian	Male	Kangmong langoljam maning leikai,Imphal west,MANIPUR,India,795134
368	Mr. Niranjay Laishram	Indian	Male	Yairipok Bishnunaha,Thoubal,Manipur,India,795149
369	Ms. Himparna Kalita	Indian	Female	Hatigaon, Juripar, Ghy-38,Kamrup(M) ,Assam,India,781038
370	Ms. K DEVIKA SHARMA	Indian	Female	Uripok Takhellambam Leikai,Imphal West,Manipur,India,795004
371	Mr. DIMPOL GOGOI	Indian	Male	SIVASAGAR, ASSAM, Indian,SIVASAGAR,ASSAM,Indian,785686
372	Mr. Shivam Maheshkumar Joshi	Indian	Male	36, Rajdeep Society, Rajcity Area, Karannagar road, Kadi,Mahesana,Gujarat,India,382715
373	Dr. Monika Wadhawan	Indian	Female	House no 3520, Street No 7, Shiv Colony,Karnal,Haryana,India,132001
374	Mr. Joseph Lalngaihawma	Indian	Male	House no. B-8, Upper Republic,Aizawl,Mizoram,India,796001
375	Dr. Sanjeev Bhattacharyya	Indian	Male	New Colony, Ward No. 7, P. O. Mangaldai,Darrang,Assam,India,784125
376	Dr. B. Ramngaihawma	Indian	Male	Ramzotlang, Lunglei,Lunglei,Mizoram,India,796701
377	Mr. RAJDEEP SARMAH	Indian	Male	Mohkina Gaon Majuli Assam ,Majuli,Assam,India,785104



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378	Dr. MOHD SUHAIL HUSAIN	Indian	Male	Aligarh, Uttar pradesh, India,Aligarh ,Uttar Pradesh ,India ,202002
379	Ms. Banawath Priynka	Indian	Female	7-11/50 Nyavanandi, Sirikonda, nizamabad,nizamabad,Telangana,India,503165
380	Ms. Ritumoni Lahon	Indian	Female	Simaluguri Lahon Gaon ,Sivasagar,Assam,India,785686
381	Ms. Monika Rani Verma	Indian	Female	Block-A, NIT-3, Faridabad,Faridabad ,Haryana,India,121001
382	Mr. Karan Nayak	Indian	Male	Madhuripathar, silapathar.MES Tunnel road, house no. 181,Dhemaji,Assam,India,787059
383	Mr. RAJKUMAR AS	Indian	Male	133A-SHRI DURGA ILLAM, NEAR VIJAYANAGAR PALACE ROAD, NEAR DISTRICT INDUUSTRIAL CENTRE,THE NILGIRIS,Tamil Nadu,India,643001
384	Mr. RAKESH BHATTA	Indian	Male	Village Barnarddi District Nalbari ,Nalbari ,Assam ,India ,781303
385	Mr. PRASANTA KUMAR DUTTA	Indian	Male	Vill-KOTOHA BORIA GAON, P.O-CHENGELI GAON, P.O-JORHAT, PIN-785010, DIST- JORHAT,JORHAT,Assam,India,785010
386	Mr. RAKESH BHIKHABHAI VADNATHANI	Indian	Male	11-SHREE MARUTI BUNGLOWS, BALVA CROSS ROAD, GANDHINAGAR, GUJARAT,GANDHINAGAR,GUJARAT ,Indian,382735
387	Ms. Anjali Suresh	Indian	Female	Palakkeel House, Malloyote, Kunhimangalam (p.o),Kannur, Kerala, 670309,Kannur,Kerala,India,670309
388	Ms. MEENAKSHI K V	Indian	Female	KURUDIAYARA HOUSE P O VALAPPAD ,THRISSUR,KERALA,Indian,6806567
389	Ms. Zohmingliani	Indian	Female	ITI veng, Aizawl,Aizawl,Mizoram,Indian,796005
390	Mr. Ritik Srivastava	Indian	Male	Village - Kakaraha , Post - Chhataha,Mirzapur,Uttar Pradesh,India,231001
391	Ms. MANIKA MALLICK	Indian	Female	Vill Balason, P. O Bhotepatti, Dost Jalpaiguri, State West Bengal,Jalpaiguri,West Bengal,India,735305
392	Ms. Riya Dey	Indian	Female	Vill.- Natagram P.O.- Natagram, P.S.- Gaighata ,North 24 Parganas,West Bengal,India,743249
393	Dr. JONALI MEDHI	Indian	Female	Sundarpur, R. G. Baruah Road, Guwahati - 781005,Kamrup (Metro),ASSAM,India,781005
394	Mr. Sausthov Maunash Bhattacharyya	Indian	Male	Solicitor Road, Ward No - 12,Jorhat,Assam,India,785001
395	Dr. Suryanarayana Gorle	Indian	Male	Dr. Gorle.Suryanarayana ,Gushini (P.O),Nellimarla (Md),Vizianagaram (Dist),535218,Vizianagaram,Andhra Pradesh,India,535218
396	Ms. PAVITHRA G	Indian	Female	Edaiyarkadu,Chettipulam,Nagapattinam ,Tamilnadu,India,614806
397	Dr. Sarit Chanda	Indian	Male	Kailashahar,Unakoti,Tripura,India,799277
398	Dr. Ashim Kumar Basumatary	Indian	Male	Vill: Thuribari, P.O: Laudonga,Kokrajhar, BTAD,Assam,India,781013
399	Ms. Shikha Vashisth	India	Female	H.No.1/4743, Street no.6, Balbir nagar extn. Shahdara, Delhi-110032,Northeast Delhi,Delhi,India,110032
400	Mr. MOHAMMED SALMAN SHAJIR P	Indian	Male	PALLOOR MAHE PONDICHERRY Indian,MAHE,PONDICHERRY ,Indian,673310
401	Ms. Sangeeta Das	Indian	Female	Flat C 14, Sammanay Housing Complex,Beltola,Bishnu Rabha Path,Guwahati,Kamrup Metro,Assam,India,781028
402	Ms. sheeba ashraf mir	Indian	Female	H.no 3 Shahi Masjid ,Mastgarh ,Jammu,Jammu,Jammu & Kasmir,India,180001
403	Mr. JAYANT KUMAR SAHOO	Indian	Male	AT/PO- SARANG, DIST- DHENKANAL, PIN-759146, ODISHA,DHENKANAL,ODISHA,Indian,759146
404	Mr. Gaurav Kumar	Indian	Male	H/26, VILLAGE RAMGAON POST PALAHIPATTI ,VARANASI,U.P,Indian,221208
405	Ms. Jyotika Boruah	Indian	Female	Bojalkata goan, dist- jorhat ,Assam,Jorhat,Assam,India,785631
406	Ms. Nusrat Jahan	Indian	Female	Mururai,Birbhum,West Bengal,India,731219
407	Ms. Swikriti Pradhan	Indian	Female	Parijat Gram, Bijanbari,Darjeeling,West Bengal,India,734201
408	Mr. Pukhrbamb Priyokumar Singh	Indian	Male	Ningthoukhong,Bishnupur,Manipur,India,795126
409	Ms. PARVEEN. M	Indian	Female	PRATHIBA NAGAR 2ND LANE 2/77, KUNNATHOORMEDU POST,PALAKKAD,PALAKKAD,KERALA,Indian,678013
410	Ms. Monika	Indian	Female	Kalayath ,Kaithal,Haryana ,India,136117
411	Mr. Prabhat Pandey	Indian	Male	House no. C-114, Second Floor (right side), Krishna Nagar, Safdarjung Enclave, ,South West Delhi,Delhi,India,110029
412	Mr. Shanker Pal	Indian	Male	Village- Tozing, P.O.- Lote,Lahaul and Spiti,Himachal Pradesh ,India,175133



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414	Ms. NEITHATUONUO MERE	Indian	Female	P.KHEL KOHIMA VILLAGE ,KOHIMA,NAGALAND ,Indian,797001
415	Ms. Sasi Kiran Gera	Indian	Female	Room No: 11, EREC Building, Mausam Bhavan Complex, Lodhi Road, New Delhi,New Delhi,New Delhi,India,110003
416	Ms. Kratika Samadhiya	Indian	Female	Keshav kunj colony, near sps school ,kosi kalan,Mathura,UTTAR PRADESH,India,281403
417	Mr. Aditya Malik	Indian	Male	H. No. 71 , Ward No. 7 , Ghikara Road , in front Street of K.N. school , Charkhi Dadri,Charkhi Dadri,Haryana,India,127306
418	Mr. RITIK KUMAR	Indian	Male	Vill- kalsi post- gangoh district saharanpur Uttar Pradesh ,Saharanpur ,Uttar pradesh ,India ,247341
419	Mr. ABDUL AZIZ	Indian	Male	House No. - 15, Nilambazar, Karimganj, Assam - 788722,Karimganj,Assam,India,788722
420	Mr. Manas Goswami	Indian	Male	Uriagaon,Nagaon,Assam,India,782003
421	Dr. C.Lalremruatfela	Indian	Male	Hno C130A, Ramhlun North, Aizawl, Mizoram,Aizawl,Mizoram,India,796012
422	Ms. Korobi Saikia	Indian	Female	Santipur Gaon, Nimati Road, P.O-785001, P.S-785001, Jorhat, Assam,Jorhat,Assam,India,785001
423	Mr. ANDARPU JABAN PATRA	Indian	Male	At/Po - Padmanabhapur, Dist - Ganjam, pin - 761007, ODISHA,Ganjam,ODISHA ,Indian,761007
424	Ms. Ajanta Deka	Indian	Female	Vill- 5 No Goreswar, Dist- Tamulpur, P.O- Goreswar, Pin no- 781366. ,Tamulpur,Assam,India,781366
425	Ms. MERIPENI EZUNG	Indian	Female	HOUSE NO. 22, NEAR MT. HERMON SCHOOL, KENUOZOU COLONY,KOHIMA,NAGALAND,Indian,797001
426	Mr. Arvind Yadav	Indian	Male	Vill-Pauharipur ,Post-Ballia,Ballia,Uttar Pradesh,India,277001
427	Ms. PUJA CHOWDHURY	Indian	Female	Mogal Pura Lane; Hooghly,Hooghly,WEST BENGAL,India,712103
428	Dr. Hari Prasad Jaishi	Indian	Male	H. No. 111, Hmarveng-II,Kolasib,Mizoram,India,796081
429	Ms. Musbita Ahmed	Indian	Female	Vill. Bengena ati, P.O: Chotahaibor, P.S: Sadar, Pin no. 782003, Dist: Nagaon, Assam,Nagaon,Assam,India,782003
430	Dr. Rabin Das	Indian	Male	Uttar Gobindapur, Kakdwip,South 24 Parganas,West Bengal,India,743347
431	Mr. Susil Kumar Nayak	Indian	Male	AT/PO- SAMIAN, VIA- SABARANG, BHADRAK, ODISHA,756123,BHADRAK,ODISHA,Indian,756123
432	Mr. SUMAN RAJ MAHANTA	Indian	Male	BAHPATI PURANI GAON POST AZAD DIST LAKHIMPUR ASSAM PIN 787031,LAKHIMPUR ,Assam,India,787031
433	Ms. Santipriya Saikia	Indian	Female	Nangal gaon, Borholla , Jorhat ,Jorhat,Assam ,India,785631
434	Mr. KHUNDRAKAM KUMARJIT SINGH	Indian	Male	Takyel Kolom Leikai, Imphal West, Manipur ,Imphal West ,Manipur,India,795113
435	Dr. Pooja Rajput	Indian	Female	ward 13- Gabli Dari, Dharamshala, Kangra, Himachal Pradesh-176057,Kangra,Himachal Pradesh,India,176057
436	Mr. TAPANJYOTI	Indian	Male	Ghoramari. Tezpur, Assam, India, 784105,Sonitpur,ASSAM,India,784105
437	Mr. Anubhob Kalita	Indian	Male	Komarmati Gaon ,Jorhat,Assam,India,785101
438	Ms. Urbashi Bora	Indian	Female	Na-Ali Dhekiajuli Buruk Brush Gaon,Jorhat,Jorhat,ASSAM,India,785009
439	Mr. Aamir Salam Siddiqui	Indian	Male	Green Building,Near Purana Kuan,Raja ka Tajpur,Bijnor,UP,India,246735
440	Mr. SHRIMANTA GOGOI	Indian	Male	Demow sukafa nagar, sibsagar(pin:785662),Sibsagar,Assam,India,785662
441	Mr. MOHAMMAD DANIAL KHAN	Indian	Male	302 SHEESH APARTMENT SHAKTI NAGAR LEKHRAJ,LUCKNOW,UTTAR PRADESH,Indian,226007
442	Ms. Babismita Nayak	Indian	Female	Housing board, gabasahi,Bhadrak,Odisha ,Indian ,756100
443	Ms. Susmita Nayak	Indian	Female	At badagada sabar sahi, po bjb nagar, bhubaneswar, Odisha ,Khordha ,Odisha,India,751014
444	Mr. Samir Thakur	Indian	Male	Balijan North TE Chabua,Dibrugarh,Assam,India,786184
445	Ms. Sushmita Maurya	Indian	Female	Mukundpatti, Khamaria, Bhadohi, 221306, U.P., India ,Bhadohi ,UTTAR PRADESH,India,221306
446	Mr. Ayush Shukla	Indian	Male	277/24 Lavkush Vihar, Naubasta,Kanpur,Uttar Pradesh,India,208021
447	Mr. Amalendu Das	Indian	Male	Pirrabani Bankura 722203,Bankura,West Bengal,India,722203



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448	Mr. Shashank Awasthi	Indian	Male	Village and Post Dalpatpur Reusa Sitapur Uttar Pradesh India ,Sitapur ,Uttar Pradesh,India,261205
449	Dr. Dipiyoti Baglari	Indian	Male	Vill: Thakur Than, P.O: Sessa, Dibrugarh, Assam, PIN-786003,Dibrugarh,Assam,India,786003
450	Ms. Manika Rawal	Indian	Female	315, Saini Gali, Old Ranipur More , Haridwar,Haridwar ,Uttarakhand ,India,249401
451	Mr. SAYAN BALA	Indian	Male	11, Abhoy Vidyalankar Road,Kolkata,West Bengal,India,700060
452	Mr. Mridul Chawla	Indian	Male	H.No. 151, Near Shiv Mandir, Moti Colony, Palwal-121102,Palwal ,Haryana ,India ,121102
453	Ms. Niha Bora	Indian	Female	Challong Pathar, Merapani ,Golaghat ,Assam ,India ,785705
454	Ms. Rashi Dayal	Indian	Female	H.no238 pakki dhakki jain bazar,jammu,Jammu,Jammu and kashmir,India,180001
455	Dr. D.Ramesh	Indian	Male	Plot no.38, Sri Ram Nagar, SBIOA School Road, Tiruchirappalli ,Tiruchirappalli ,Tamil Nadu ,India,620007
456	Ms. Sarika Kumari	Indian	Female	Shiv Shakti Colony, Chas, Bokaro, Jharkhand 827013,Bokaro,Jharkhand,India,827013
457	Dr. Biswajit Sarma	Indian	Male	Beharbari, House No. 2, Guwahati-28, Assam, India,Kamrup Metro,Assam,India,781028
458	Mr. Akhil Hazarika	Indian	Male	Village Parbatia Gaon near NEIST Jorhat Assam ,Jorhat,Assam,India,785006
459	Ms. Anindita Dasgupta	Indian	Female	4/1/3 Russa Road south 1st lane, Tollygunge , Kolkata - 700033,South 24parganas,WestBengal,India,700033
460	Mr. MOHAMMAD SHUJA NABEEL	Indian	Male	New Delhi,Southeast Delhi,Delhi,India,110025
461	Mr. Himangshu Kumar Hazarika	Indian	Male	Bihpuria, ward no-1, College Road, near SBI,Lakhimpur ,Assam,India ,784161
462	Dr. Dr. R.SAKTHIVEL	Indian	Male	33, VPR GIRI ILLAM, ACT NAGAR, NEAR BAJAJ SHOW ROOM, PERIYAPALAM, KULITHALAI,KARUR,TAMIL NADU,Indian,639104
463	Mr. SUDIPTO BHATTACHARJEE	Indian	Male	27, GOBRA GOROSTHAN ROAD, ,KOLKATA,WEST BENGAL,Indian,700046
464	Mr. Vansh Punit Grover	Indian	Male	22B 1st floor Cycle Society Near YMCA Club Nana Peth,Pune,Maharashtra ,India,411002
465	Mr. Naman Jitendra Rathod	Indian	Male	A-804, Isha Emerald Society, Bibwewadi-Kondhwa Road, Near Gangadham,Pune,Maharashtra,India,411037
466	Mr. Pritam Das Kashyap	Indian	Male	Rajgarh Road Lane 7 House 2 Guwahati,Kamrup Metro,Assam,India,781003
467	Dr. Shashi Kant Sah	Indian	Male	Village- Pandey Pipra, Post- Shukla Pipra, Mohania,Kaimur,Bihar,India,821109
468	Dr. SANJAY KUMAR PRAJAPATI	Indian	Male	ROOM NO 512 SATMET BUILDING MAUSAM BHAWAN COMPLEX LODHI ROAD NEW DELHI 110003,NEW DELHI,Delhi,Indian,110003
469	Dr. Dr. AUCHITYA KUMAR PANDEY	Indian	Male	VILLAGE- JAMDHI PANDEY, POST- LABNAPAR, BASTI,BASTI,UTTAR PRADESH,Indian,272001
470	Mr. Sachin Narayanrao Khupat	Indian	Male	C 204 sahyadri utsav nandoahi road kirkatwadi Pune,Pune,Maharashtra ,India,411024
471	Ms. NEETASHRI BORAH	Indian	Female	NIZ KADOMONI,BISHNU PATH, BOIRAGIMOTH, DIBRUGARH ,DIBRUGARH ,ASSAM,Indian,786003
472	Mr. Gourisankar Majhi	Indian	Male	Bhuban,Dhenkanal,Odisha,India,759017
473	Ms. Barsha Rani Singha	Indian	Female	Kamarbunh T. E., PO: Gotanga, Jorhat, Assam , Pin:785616,Jorhat ,Assam ,Indian ,785616
474	Mr. Mehilo Apon	Indian	Male	House no 44, Perizie Colony, Kohima, Nagaland - 797001,Kohima,Nagaland,India,797001
475	Ms. Priyashree Borkotoky	Indian	Female	Teok,Jorhat ,Assam,India,785682
476	Mr. Naveen Singh	Indian	Male	Thatyur Tehri Garhwal,Tehri Garhwal,Uttarakhand ,India,246174
477	Ms. AGINA CHANDRAN K	Indian	Female	Aginabhinam, Valankichal, Kannur, Kerala ,Kannur,Kerala,India ,670741
478	Dr. Ashutosh Singh	Indian	Male	1389/26, Vivekanand Nagar,Sultanpur,Uttar Pradesh ,India,228001
479	Prachurjya Borthakur	Indian	Male	Rajguru Gaon, Dhekorgarah Jorhat, Assam, India, 785001
480	Kasulanati Venkata Rama Hanumanth Prasad	Indian	Male	D. No. 1-132-2, Sanampudi, Guntur, Andhra Pradesh, India, 522646.

An International Virtual Workshop on Global Seismology and Tectonics (IVWGST-2020)

Santanu Baruah^{*1}, Chandan Dey¹, Prachurjya Borthakur¹, G. Narahari Sastry², and Andrew J. Michael³

Abstract

An International Virtual Workshop on Global Seismology and Tectonics (IVWGST-2020) was organized by the Geoscience and Technology Division of Council of Scientific and Industrial Research—North East Institute of Science and Technology, Jorhat, India from 14 to 25 September 2020. This workshop predominantly catered to undergraduate, postgraduate, and Ph.D. students, scientists, and academicians from across the globe. The primary motive of IVWGST-2020 was to inspire the participating students, perturbed by the unprecedented situation brought about by the COVID-19 pandemic, with quality lecture sessions, so as to lift their spirits. The virtual workshop served as a conduit for the students and researchers to directly interact with several pioneers and prominent geoscience researchers from around the world. Lectures, via Microsoft Teams, were given by 15 eminent speakers from diverse geoscience forums and institutions, and were attended by more than 1000 participants, mostly students and researchers, from 30 different countries. This report briefly summarizes the agenda, describes our experiences hosting the virtual workshop, and documents the challenges faced.

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Introduction

The COVID-19 pandemic has severely constrained and paralyzed almost every walk of life, and subjected people to unparalleled challenges. Although the world looked to science for answers, the research and academic community looked for stability and reassurance. This unexpected hiatus has undoubtedly taken a toll on the morale of students pursuing undergraduate and graduate degrees, as well as postdoctoral fellows, as they seek to revamp their academic, research, and career goals. Even established researchers, especially those who rely on field work, have suffered setbacks in accomplishing their plans.

During this unprecedented situation, virtual or internet-based events have been among the few exceptional sources of stimulation and inspiration for the students and faculty to maintain connection with research, scientific, and academic activities. The silver lining behind the harsh situation is that these virtual events have created a conduit for direct access to experts from across the globe, who otherwise are rarely available for direct interaction with such broad audiences. Even as webinars or virtual seminars and lectures were on the rise in the pre-COVID-19 era, the real benefits and potential of e-events were hugely underestimated due to preferences of attending physical sessions over e-sessions.

Taking a cue from global trends, Geoscience and Technology Division (GSTD) of Council of Scientific and Industrial

Research North East Institute of Science and Technology (CSIR-NEIST), Jorhat, Assam came up with the idea of hosting an International Virtual workshop on Global Seismology and Tectonics (IVWGST-2020), aiming to boost the morale of the students and researchers by providing opportunities to interact with prominent researchers in seismology and tectonics. In the past, CSIR-NEIST has successfully conducted the Summer Research Training Program (CSIR-SRTP) with over 16,000 students in different disciplines. Thus, CSIR-SRTP provided an excellent platform to conduct this workshop. The goal of organizing IVWGST-2020 was to provide students and researchers, from undergraduates to established scientists and academicians from across the globe, with high-quality lecture and e-study materials, including awarding an e-certificate for participation, without any cost. The event was held virtually via the internet-based video conferencing platform Microsoft Teams (MS teams) and also live streamed via the Facebook and YouTube channels of the institute.

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Global seismology and tectonics*

A twelve-day 'International Virtual Workshop on Global Seismology and Tectonics' was organized recently to bring national and international experts together and boost the morale of the students and researchers during the COVID-19 pandemic by providing opportunities to interact with eminent scientists in the domain of seismology and tectonics.

G. Narahari Sastry (Director, CSIR-North East Institute of Science and Technology, Jorhat), who inaugurated the workshop, emphasized the impor-

tance of computational technology in every branch of science and research. The workshop was chaired by J. R. Kayal (former Deputy Director General, Geological Survey of India, Kolkata). About 1000 participants from 30 countries registered for the event. Fifteen eminent speakers from different geoscience institutions delivered lectures and each of the lectures was attended by about 800 participants. The lectures by the keynote speakers covered all major aspects of seismology. Sixteen lectures were delivered during the workshop and are briefly highlighted here.

Andrew J. Michael (United States Geological Survey (USGS)) gave a talk on 'Why it is hard to count earthquakes: estimating catalog completeness'. He discussed that it is now much easier to

acquire earthquake event information from institutions such as the USGS or the International Seismological Centre (ISC), than in the past. While the advances are positive, it also means that researchers may not be in contact with the catalogue creators, who can advise them on its strengths and weaknesses. Over time, seismic networks have also become much better with more stations, higher quality seismometers, digital recording and improved analysis methods. However, it is important to understand how these advancements affect earthquake catalogs.

Michael also discussed 'The Poisson assumption: applications in spite of clustering'. He discussed how the Poisson probability distribution is frequently used to describe the temporal behaviour of

*A report on the International Virtual Workshop on Global Seismology and Tectonics (IVWGST-2020) organized by the CSIR-North East Institute of Science and Technology, Jorhat, Assam, from 14 to 25 September 2020.

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- To understand scrupulously the geodynamics of northeastern India and its vicinity.
- Pursue Earth science towards earthquake hazard estimation and its mitigation.
- Thrive for innovative idea/technology to make the region earthquake disaster resilient



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