


Curriculum Vitae

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COMPUTATIONAL SKILLS

OS	<i>Linux, Windows, Mac</i>	Scripting	<i>Bash Shell</i>
Programing	<i>FORTRAN, Python</i>	Package	<i>Origin, MS-Office, Gnuplot</i>
Scientific	<i>SAC (Seismic Analysis Code), MATLAB, GMT (Generic Mapping Tool), Octave</i>		

RESEARCH WORK AND EXPERIENCE

August, 2015 to present **Final year BS-MS student at [IISER Kolkata Seismological Observatory](#)**

Research Interest Computational Seismology, Continental Tectonics

Projects:

August, 2016 to present **“High frequency seismic attenuation in North-East India, IBCZ and Eastern Himalaya”**
IISER Kolkata, Supervisor: Prof. Supriyo Mitra

Seismic waves attenuates due to scattering of energy and an-elasticity of the medium. Attenuation is defined using the quality factor (Q) represented by the ratio of the total energy in the waveform to the energy lost per cycle as the wave propagates. Quantitative estimate of attenuation is achieved by measuring the spatial or temporal decay of wave amplitude. At local distances (epicentral distance < 350 km), this information can be abstracted from the temporal decay of coda wave amplitudes. We have used single-backscattered model to measure the amplitude decay after a lapse time of twice the S-wave arrival time. Attenuation of seismic energy has been observed to be frequency dependent. We, therefore, perform the measurement for a range of frequencies between 1 and 18 Hz.

For the Eastern Himalayan plate boundary system, comprising the Eastern Himalaya, NE-India and the Bengal Basin, we perform our measurements for 706 event-receiver paths. 1-D average measurements yield Q at 1 Hz (Q_0) and its frequency dependence (η), which is then combined through a tomographic inversion (using back-projection algorithm) to obtain 2-D maps of lateral variations of Q at every frequency of our choice. We also find qualitative relation between Q and shear wave velocity.

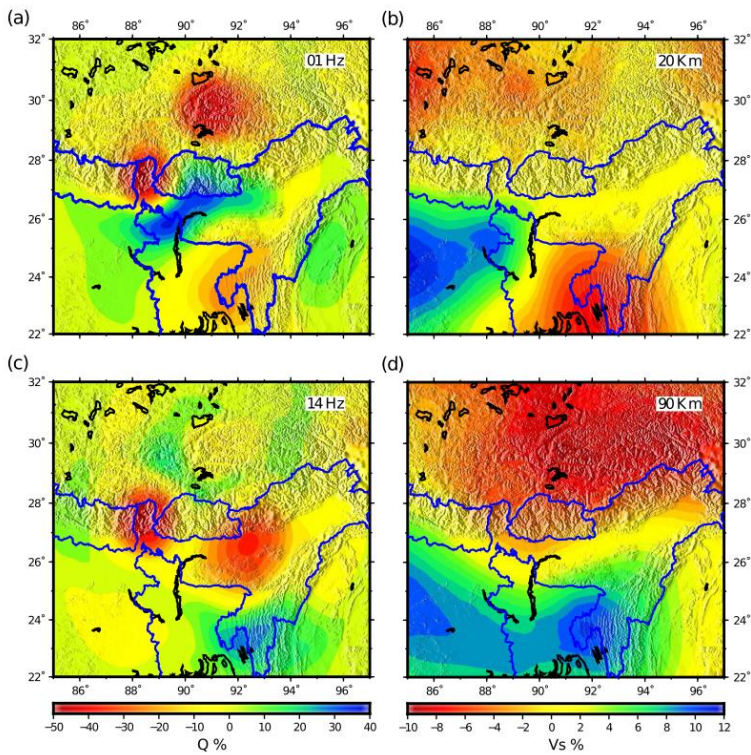


Figure 1

Figure 1(a), (b) and (c), (d) shows qualitative correlation between Q at 1 Hz and Shear wave velocity at 20 Km depth and Q at 14 Hz and shear wave velocity at 90 Km depth. Our results of coda-Q tomography is shown in figure 2 (a) with frequency dependence of Q (i.e. η) in figure 2 (b).

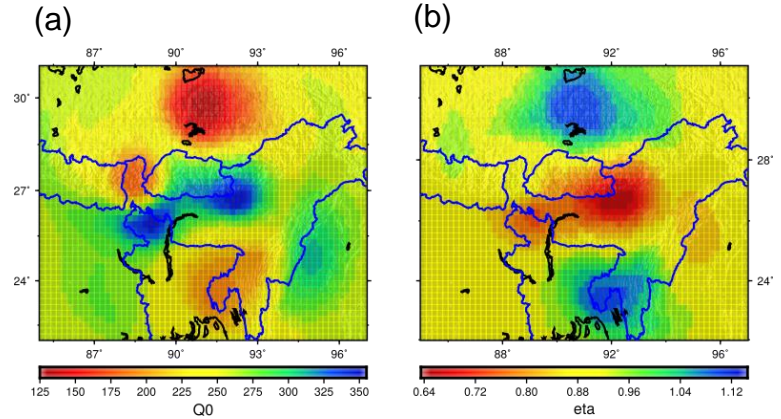


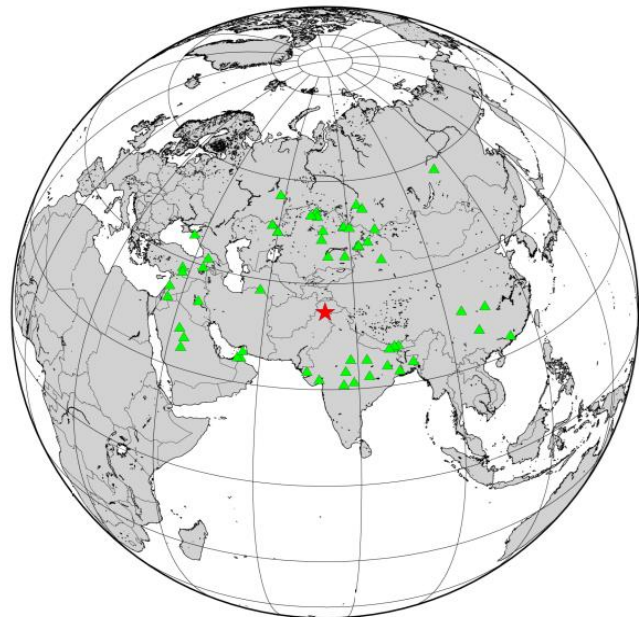
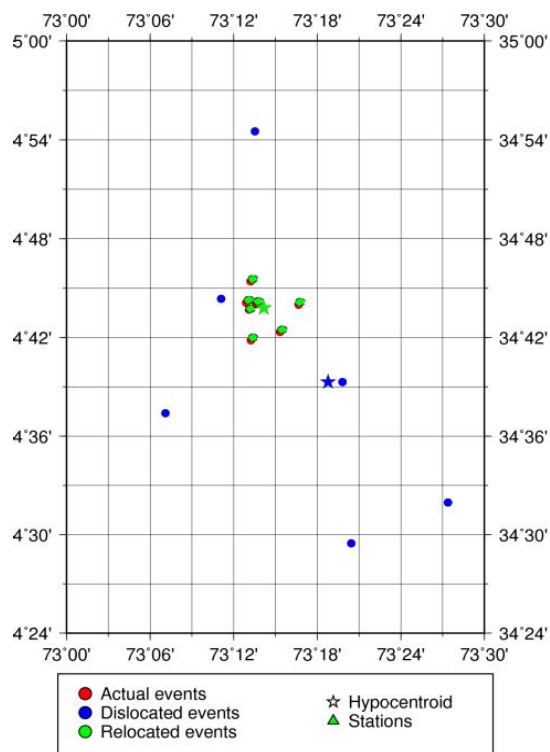
Figure 2

July, 2017

“Earthquake Relocation using Mlocate Program”

Bullard Laboratories, *Univ. of Cambridge*, Supervisor: Prof. Keith Priestley

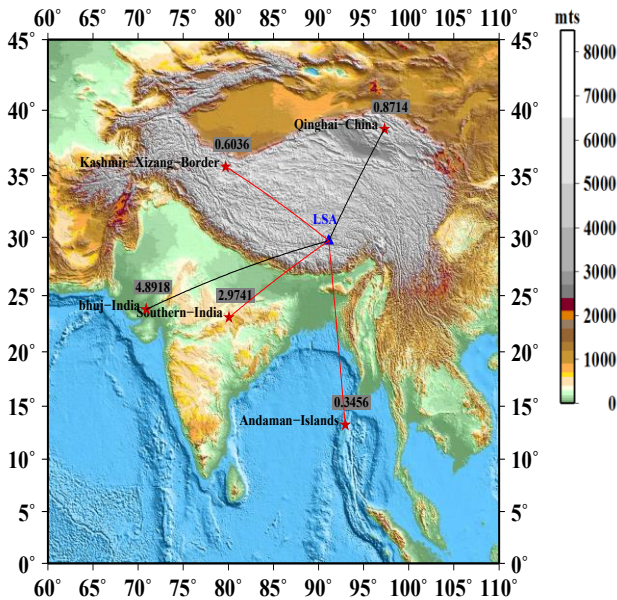
The theory behind Earthquake relocation has been studied. I have learned to use Mlocate programs written by Eric Bergman (1989) for Earthquakes relocation. Since the programs were written quite long back, therefore needed some debugging. The algorithm used in programs were based on ‘Hypocentroid Decomposition Theorem’. I have used 7 earthquakes (Fig. red dots) in Kashmir region of India. All these earthquakes were dislocated (Fig. blue dots) and then relocated (Fig. green dots) using Mlocate. The phase data used in relocation for the given set of stations (Fig. green triangles), were generated synthetically using TauP (*Crotwell et al*, 1999). All the earthquakes were relocated precisely with uncertainty ellipses around them.



July, 2016

“Lg wave propagation and simulation in Indian and Tibetan Plateau”

Earthquake Research Institute, Univ. of Tokyo, Supervisor: Prof. Takashi Furumura



The regional seismic phase, Lg propagate in stable continent region. 5 seismic events (map) recorded at GSN station LSA were chosen to analyze the Lg propagation in Indian and Tibetan Plateau region. 3 profiles were selected (The red paths in map) for Lg wave simulation (2D FDM) and synthetic waveforms compared to the waveforms recorded at LSA station. The efficient LG blockage was observed in Tibetan Plateau and the Q values are found to be much lower than expected along the path from Kashmir Xizang border to LSA which is in agreement with Fan and Lay, 2002

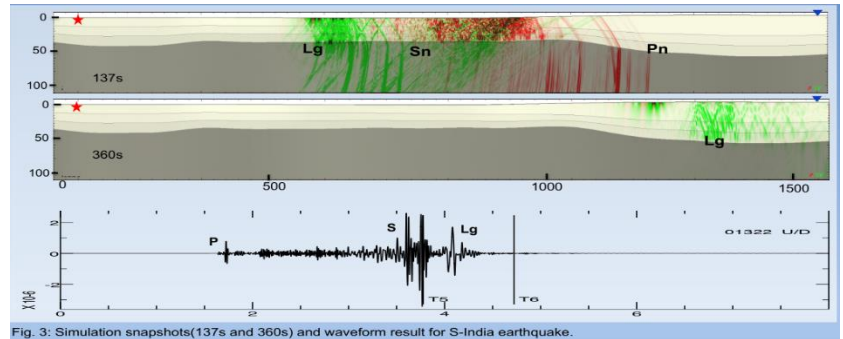
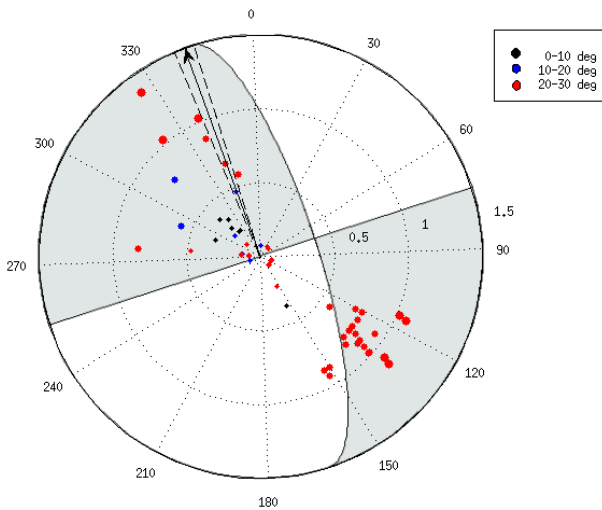


Fig. 3: Simulation snapshots(137s and 360s) and waveform result for S-India earthquake.

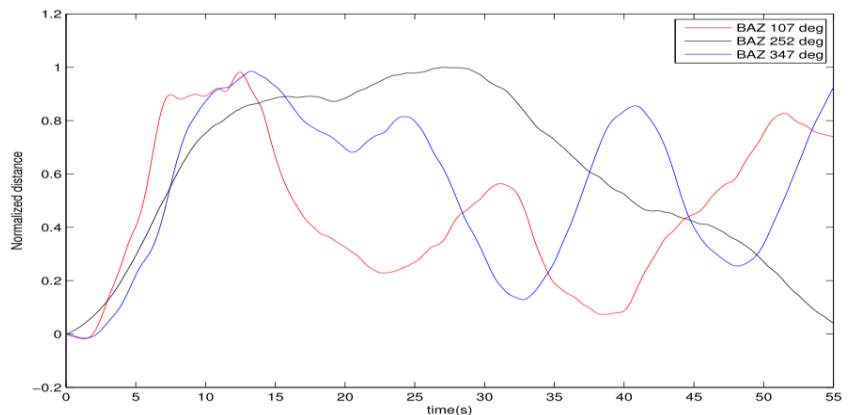
May, 2016 to June, 2016

“Fault rupture directivity using P-wave spectra corner frequency”

IISER Kolkata, Supervisor: Prof. Supriyo Mitra



Earthquakes does not occur at sudden, they occur from the result of slip on a fault. A rupture is the portion of a fault that slips during the event. It propagates with a definite velocity. The direction of rupture propagation can be found by using corner frequency. Seismic energy propagates in all direction from hypocenter with higher frequencies in the direction of rupture. Rupture directivity helps us to distinguish between the fault plane and auxiliary plane of an Earthquake. Here, the fault plane is distinguished from the auxiliary plane for Manipur, 2016 Earthquake. From the waveform figure we can see the higher frequency waveform in the direction of rupture and lower frequency in the direction perpendicular to rupture.



May, 2015 to July, 2015

“Time delays in inhomogeneous optical media”

Indian Institute of Technology Madras, Supervisor: Prof. Harishankar Ramachandran

The project was based on the study of Time delays occur when a light wave passes through inhomogeneous optical media. Here, we tried to understand the seismic wave propagation from the Earth structure by simulating the light waves through inhomogeneous optical media.

May, 2014 to July, 2014

“Instrumentation for Velocity Map Imaging Mass Spectrometer”

IISER Kolkata, Supervisor: Dr. Dhananjay Nandi

The project was based on the study of Instruments use in Velocity Map Imaging (VMI). All instruments like vacuum pump, vacuum chamber, electron gun, faraday cup, magnetic coil, mass spectrometer, detector and their basic principles were studied.

SEMINARS AND CONFERENCE ATTENDED

- Presented **Poster** ‘*Seismic attenuation of the Eastern Himalayan plate boundary system*’ in conference “Advances in Modern Earth System Sciences - 2016” held at IISER Kolkata on 25th – 26th March, 2017
- Attended a **GIAN** (Global Initiative of Academic Networks) course: ‘*A short course on Continental Tectonics*’ conducted by **Prof. James Jackson, Cambridge University** held at IISER Kolkata.
- Presented **Poster** ‘*Lg wave propagation and simulation in Indian and Tibetan Plateau*’ at Earthquake Research Institute, **University of Tokyo, Japan** during SAKURA Science Program (July, 2016).
- Attended **Summer School on Crystallography, Mineralogy, Thermodynamics and Mantle Petrology** organized by National Centre for High Pressure Studies, IISER Kolkata and funded by **Ministry of Earth Sciences**, from 6th to 17th June, 2016
- Organized and attended **Asia Student Photonics Conference, 2014** funded by **SPIE**, held at Kolkata and saw participations from 10 Asian Countries and speakers around the Globe.
- Attended **Winter School on Photonics-2013** held at **IISER-Kolkata** which saw participation from over 180 research scholars across the country.

HONORS AND AWARDS

- **Scholarships**
 - Received the **Innovation in Science Pursuit and Inspired Research Fellowship Grant** from **Department of Science and Technology**, Govt. of India (August 2013 –ongoing).
 - Received **JST Sakura Science Fellowship** provided by Japan Science and Technology Agency for pursuing a short-term research at Earthquake Research Institute, University of Tokyo, Japan (July 2016)
- **Awards**
 - Ranked in **98.8 percentile** in the prestigious Indian Institute of Technology Joint Entrance Exam (**IIT-JEE**) -2013
 - Ranked in **99.4 percentile** in the Uttar Pradesh State Entrance Exam (**UPSEE**)- 2013.
 - Awarded by **District Magistrate** for scoring highest marks in Secondary Examinations.

COURSES STUDIED

- **Earth Sciences** **Theory**

Planetary Earth and Environmental Science, Earth System Processes, Mineralogy and Geochemistry, Structural Geology, **Geophysics**, **Geodynamics**, Paleontology, Igneous and Metamorphic Petrology, Hydrology and Geotechnical Engineering, **Introduction to Seismology**, Sedimentology and Principles of Stratigraphy, Isotope Geoscience, **Inverse Theory** (Geophysics), GIS and Remote Sensing, Geology of Natural Resources, Stratigraphy, Principles of Paleontology.

Lab Courses

Sedimentology Laboratory, Mineralogy Laboratory, Structural Geology Laboratory, Petrology Laboratory, Geochemistry Laboratory, **Seismology laboratory**, Paleontology Laboratory.

- **Physical Sciences** **Theory**

Mechanics, Thermodynamics, Electricity and Magnetism, Quantum Mechanics I, Waves and Optics.

Lab Courses

Mechanics Lab, Electricity and Magnetism Lab, Experimental Physics III Quantum & Atomic Physics, Optics Laboratory, Basic, **Computational Physics Lab**, Advanced Optics Lab, Electronics and Instrumentation.

- **Mathematical Sciences** **Theory**

Single Variable Analysis, Linear Algebra and Ordinary Differential Equations, Complex Variables and Applications, Probability and Statistics.

- **Chemical Sciences Theory**

Chemistry of Elements, Energetics and Dynamics of Chemical Reactions, Spectroscopy and Other Physical Methods for Molecules and Solids, Bonding Structure and Symmetry.

Lab Courses

Synthesis and Chromatography, Qualitative and Quantitative Experimental Analysis, Physical chemistry Lab.

- **Biological Sciences** **Theory**

Cell Biology, Genetics, Evolutionary Biology, Ecology.

Lab Courses

Introductory Biology lab, Biochemistry Practical.

FIELD EXPERIENCE

- **Vadodara (22.3° N, 73.2° E), Gujarat, India** along **Mahi River** basin
under the guidance of Prof. Prasanta Sanyal and Dr. Manoj K. Jaiswal

Objectives:

- To observe the past depositional environment along the Mahi River basin and make litho logs using the data collected from the field.

- To observe the thin sections of samples collected from the field and try to deduce past climatic conditions.
- **Tohoku Region (40.7° N, 141.3° E), Japan**
under the guidance of Prof. Masa Kinoshita and Prof. Kenji Satake

Objectives:

- To observe the damage caused by the 2011 Tohoku Earthquake and Tsunami and how they are recovering from the loss.
 - Visit to Yuriage, Matsushima, Onagawa and Kesen'numa. At Yuriage, visit memorial museum and listen to first-hand account from tsunami survivors.
- **Ghatsila and Galudih (24.5° N, 86.5° E), Jharkhand, India**
Under the guidance of Dr. Kathakali Bhattacharyya and Dr. Sitindra Sundar Dirghangi

Objectives:

- Illustration and implementation of geological mapping techniques.
- Geometric and kinematic analysis of deformational structures in rock such as folds, superposed folds, faults, planar and linear fabric.

EXTRA CURRICULAR ACTIVITIES AND POSITIONS OF RESPONSIBILITY

- 2017: Selected in National Institute Ranking Framework (NIRF) committee of IISER Kolkata to design and maintain Institute website and web portals.
- 2014: Former **Vice – President** SPIE Student Chapter IISER Kolkata.
- 2014: Held the position of **Secretary** in an Asian level event Asia Student Photonics Conference, 2014 held at Kolkata.
- 2014: Volunteered in **National Science Camp**, Vijyoshi – 2014.
- 2014 – 2015: Worked as Webmaster in **Inquivesta – 2015** (India's largest Science Festival) and **Students Affairs Council (SAC)** of IISER Kolkata.
- 2014: Former **Convener** of Trekking and Allied Sports Club, IISER Kolkata.

OTHER INTERESTS

Event management, Web Designing (HTML, CSS, JavaScript, PHP), Trekking, Adventure Sports, and Kabaddi

REFERENCES

Prof. Supriyo Mitra, Professor, Indian Institute of Science Education and Research Kolkata, India

Contact: supriyomitra@iiserkol.ac.in

Prof. Takashi Furumura, Professor, Earthquake Research Institute, University of Tokyo, Japan

Contact: furumura@eri.u-tokyo.ac.jp

Prof. Keith Priestely, Professor, Bullard Laboratories, University of Cambridge, United Kingdom

Contact: kfp10@cam.ac.uk