EGU22-5885

Seismic Attenuation Characteristics of India, Himalaya and Tibet using Lg-Coda waves

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Why study Attenuation?

➢ **Understanding the crustal structure, evolution and dynamics**

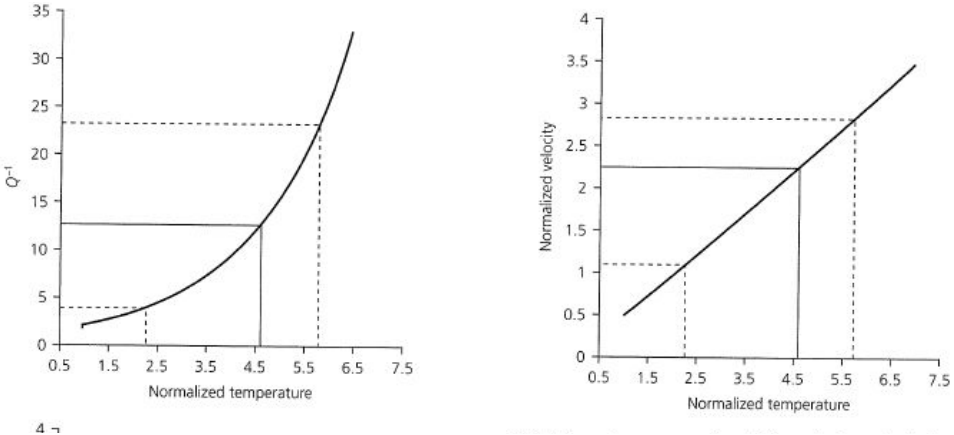

Fig: Variation of attenuation (left) and seismic velocity (right) with temperature changes (Romanowicz, 1995, *Journal of Geophysical Research: Solid Earth*)

➢ **Quantification of seismic hazard**

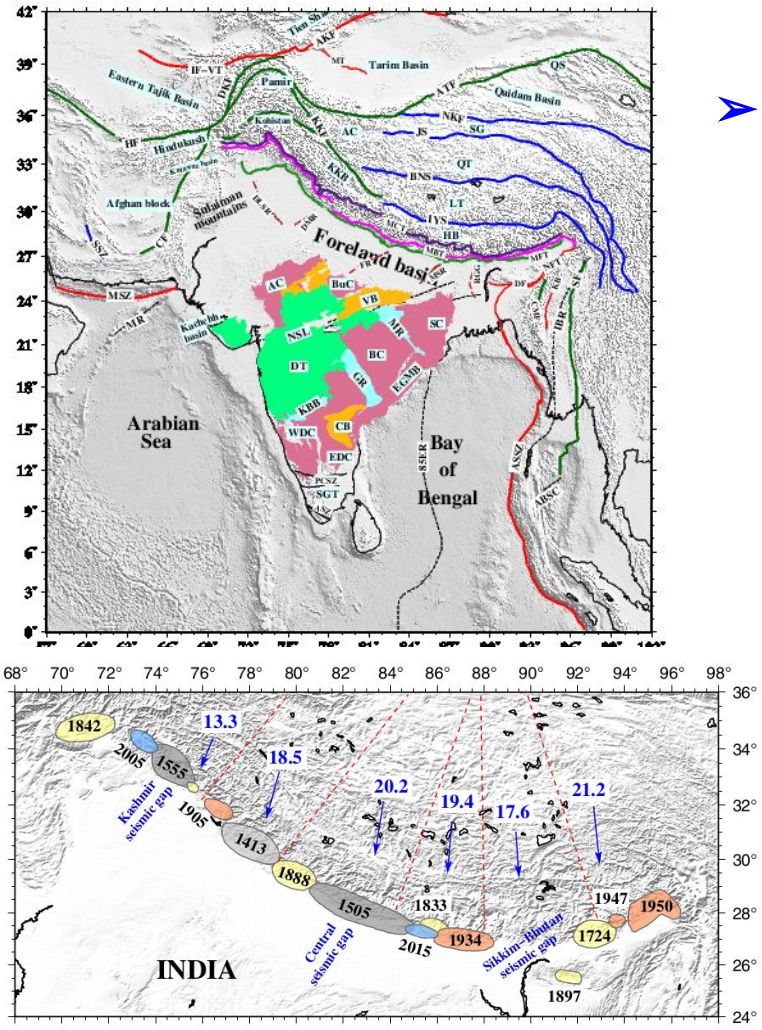

Fig: (Top left) Our region of interest (Bottom left) Topographic map of the Himalaya with the rupture patches of major earthquakes labeled by the year of occurrence (Sharma et al., 2020, *Seismological Research Letters*).

Computation of Q_0 and η - Stacked Spectral Ratio (SSR) Method

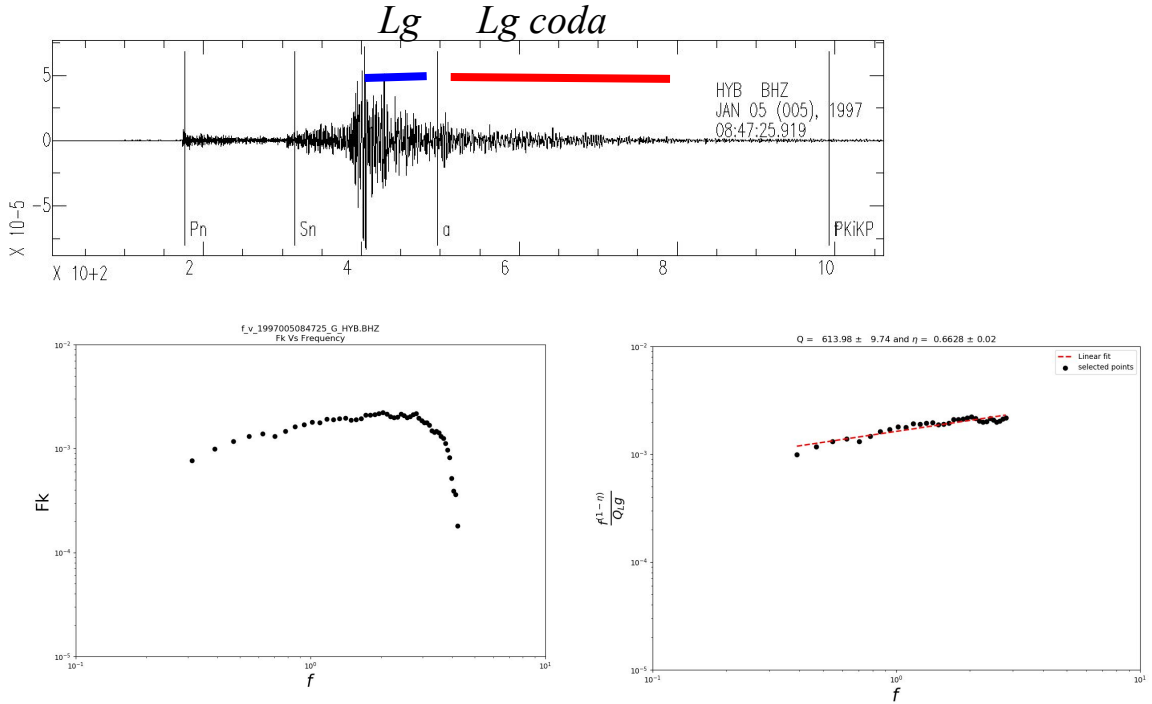

Fig: (Top) Vertical component seismogram from a moderate size (M5.5) regional earthquake for a relatively high-Q path in India. The event has a depth of 24 km and an epicentral distance of 1389 km. (Bottom) Stacked spectral ratio as a function of frequency for the above seismogram.

The stacked spectral ratio (SSR) method, stacks spectra from several pairs of windows along the coda of Lg. That process leads to

$$E(F_k) = \frac{f_k^{1-\eta}}{Q_0}$$

as the expression for the SSR, or in logarithmic form

$$\log_{10} F_k = (1-\eta)\log_{10} f_k - \log_{10} Q_0 + \epsilon$$

which is a standard linear regression problem in which $\log_{10} Q_0$ and η, can be estimated.

(Xie and Nuttli, 1988, *Geophysical Journal International*)

Data

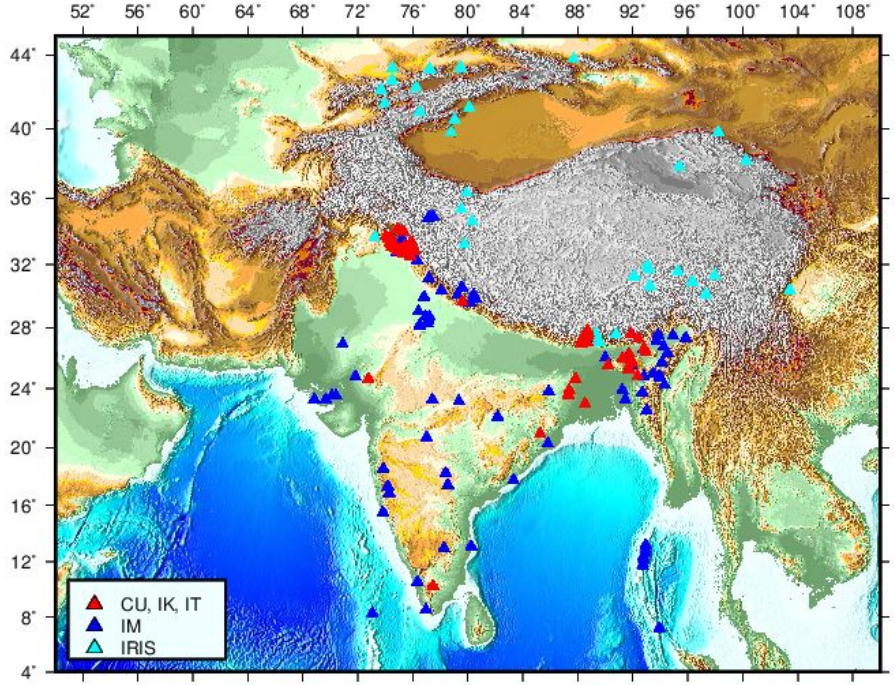

Fig: Map of all the stations used colour coded according to network

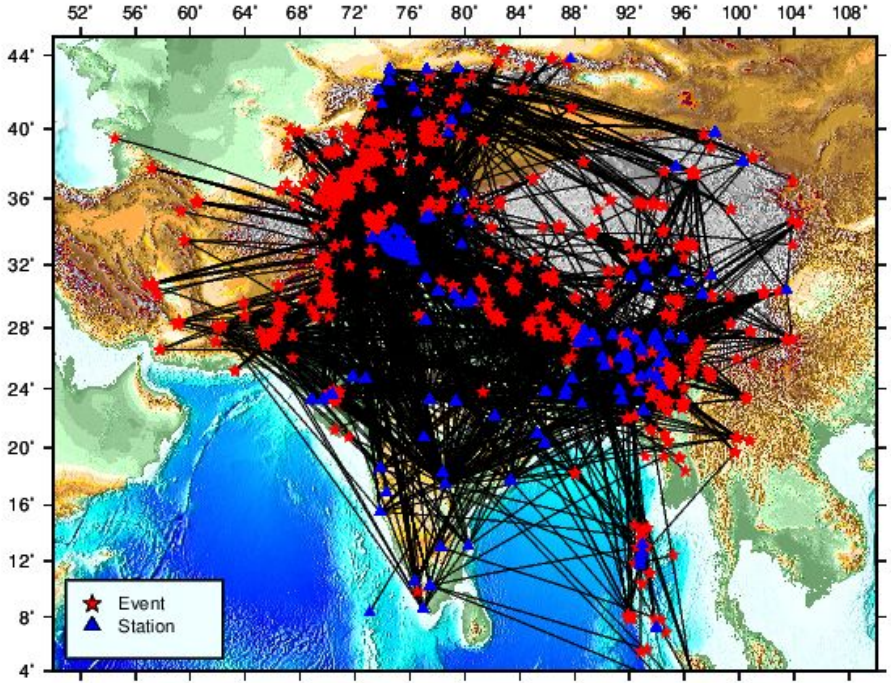

Fig: Raypath coverage map - total of 2634 raypaths here

Q_0 and η measurements for NW Himalayas

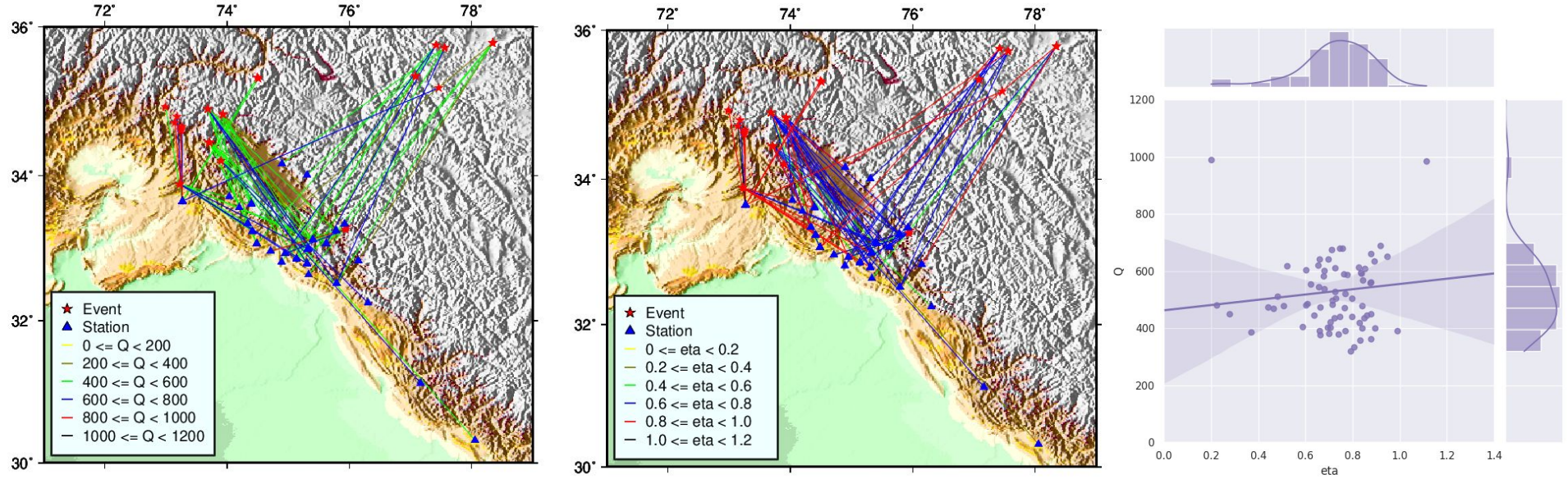

Fig: (Left) Raypath maps colour coded wrt Q_0 values. (Middle) Raypath maps colour coded wrt η values. (Right) Plot of Q_0 vs η with their distributions.

Error weighted average of Q_0 = 482.186

Error weighted average of η = 0.735055

Q_0 and η measurements for Eastern and NE Himalayas and Indo-Burman Plate Boundary Systems

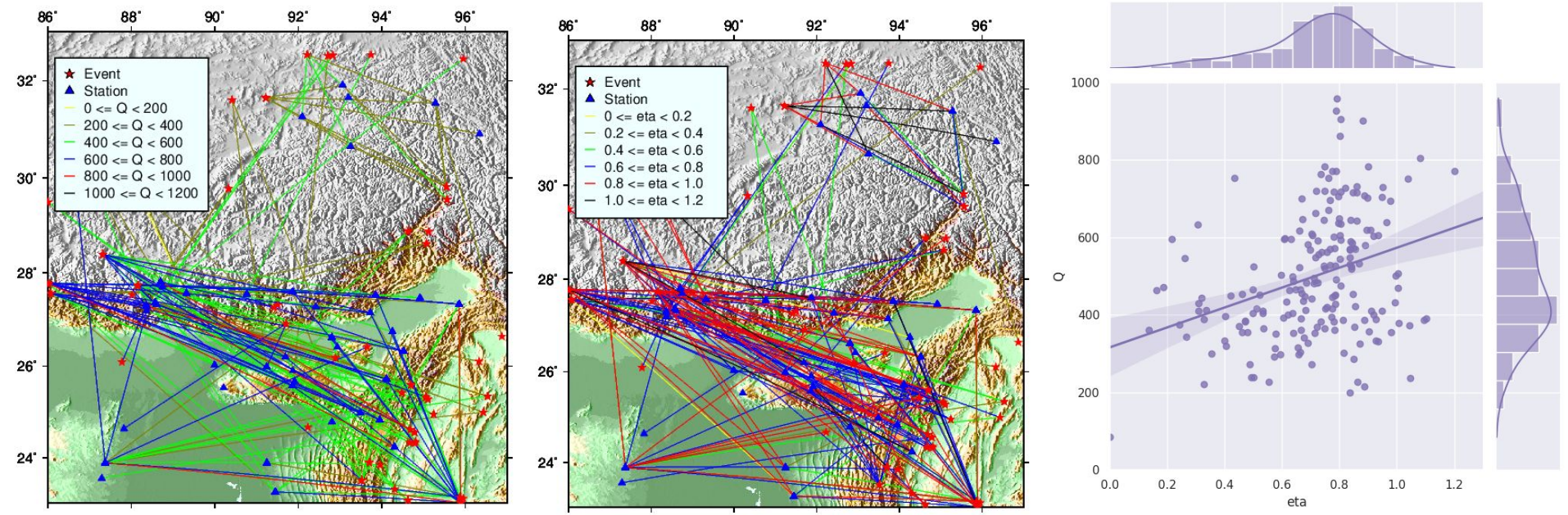

Fig: (Left) Raypath maps colour coded wrt Q_0 values. (Middle) Raypath maps colour coded wrt η values. (Right) Plot of Q_0 vs η with their distributions.

Error weighted average of Q_0 = 466.136

Error weighted average of η = 0.733232

Q_0 and η measurements for the Indian Shield

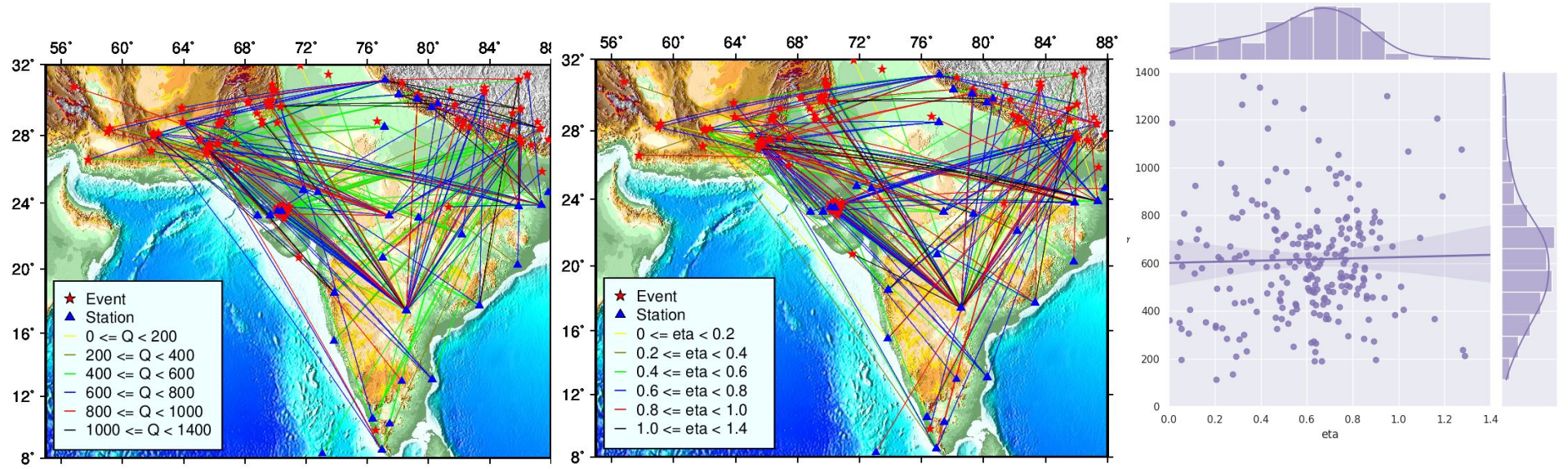

Fig: (Left) Raypath maps colour coded wrt Q_0 values. (Middle) Raypath maps colour coded wrt η values. (Right) Plot of Q_0 vs η with their distributions.

Error weighted average of Q_0 = 589.116

Error weighted average of η = 0.628227

Future Work

- Do a 2D ellipse based tomography.
- Use a sensitivity kernel based tomographic inversion to improve lateral resolution.