Source Spectral Studies Using Lg Wave in Western Tibet

Sukanta Sarkar, Namrata Jaiswal, Chandrani Singh, Arun Kumar Dubey and Arun Singh
Department of Geology and Geophysics, Indian Institute of Technology Kharagpur

Introduction

The tectonic structure of western Tibet is complex and formed of several blocks, which are separated by distinct suture zones. In this study, Lg wave has been used for the estimation of attenuation factor (Q), corner frequency (f_c) and moment magnitude (M_w) of earthquakes. Attenuation characteristics of Lg waves can help us to understand the complex tectonics and geodynamics of a region.

Data and Methods

Study region lies between 29°N – 40°N and 75°E – 88°E. The Lg data set used for the present study is taken from Y2 network (IRIS).

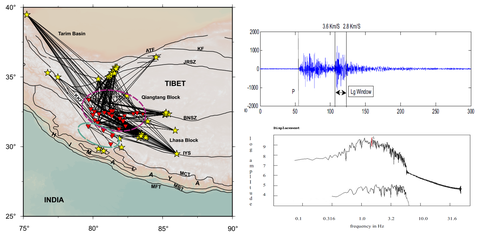


Figure 1: (Left) Ray path showing the zone wise data set across KKF fault in the study area; (Right) A seismogram and a displacement spectrum is shown.

- The Y2 network was equipped with 26 Streckeisen STS-2 type seismometers, with a sampling rate of 100 samples/s.
- The selected earthquakes occurred between October 2007 to April 2011.
- Signal-to-Noise ratio > 2.5.
- The earthquake should be recorded at a minimum of four stations.
- The Lg group velocity window is considered between 3.0 – 3.6 km/s.

To calculate the average Q values and M_w:

$$A_{ij}(f) = S_i(f)L_j(f)G(D)exp[-(\pi f D)/(v(Q_{Lg}^{-1}))] \quad (1)$$

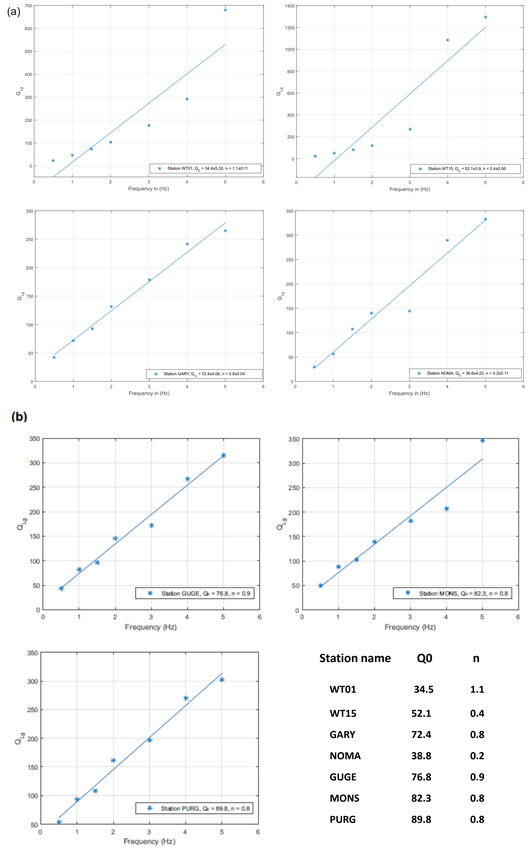
Q variation with frequency is given by [4]:

$$Q_{Lg}(f) = Q_0 f^n \quad (2)$$

M_w scale is given by [3]:

$$(M_w) = (2/3)log(M_0) - 6.06 \quad (3)$$

Results: Variation of Q across KKF



Station name	Q0	n
WT01	34.5	1.1
WT15	52.1	0.4
GARY	72.4	0.8
NOMA	38.8	0.2
GUGE	76.8	0.9
MONS	82.3	0.8
PURG	89.8	0.8

Figure 2: Station wise Q variation with frequency; (a)Zone I, (b) Zone II

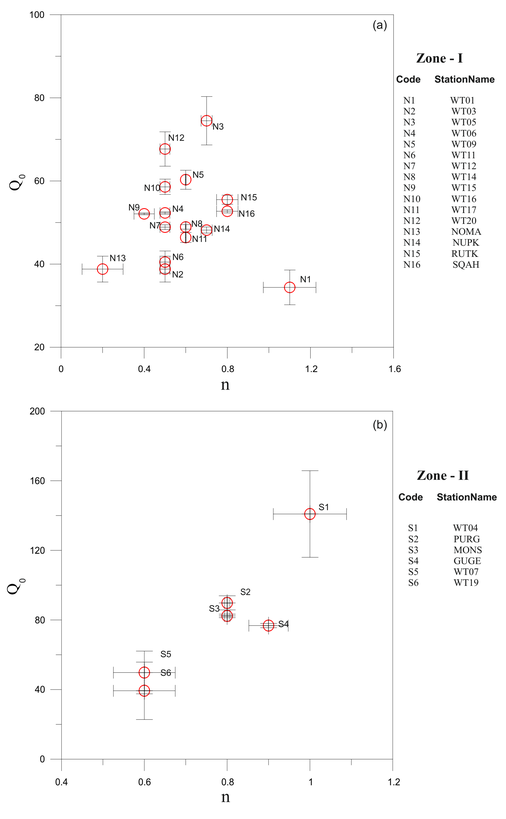


Figure 3: Variation of Q_0 values with 'n' for Y2 network.

Results: f_c vs dist. & M_w vs M_l

The obtained results show that overall more than 90% of the events have corner frequency $(f_c) > 1$ Fig. (4). Both the regions exhibit a decreasing trend of f_c with distance.

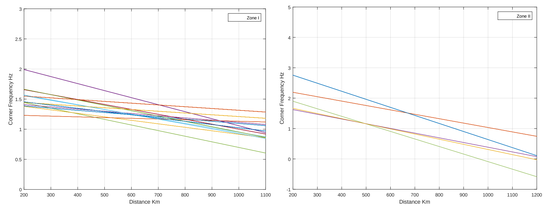


Figure 4: Zone wise variation of apparent corner frequency of Lg amplitude spectra with distance across KKF, (Left: Zone I and Right: Zone II).

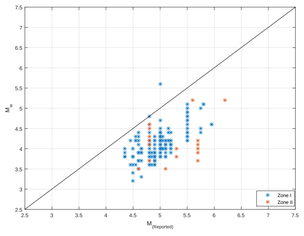


Figure 5: Variation of moment magnitude (M_w) with reported magnitude (M_l). Blue star represents Zone I and Orange star represents Zone II

Zonewise average Q_{Lg} and n

Zone	Q	n
Zone 1	56.4	0.79
Zone 2	64.87	0.87

Conclusion

- The obtained results show a strong correlation with the crustal structure, but no such variation in Q is observed across the KKF.
- This entire region is highly attenuative. This may be due to the scattering effect because of the continent-continent collision between the Indian and the Eurasian plate or may be due to the intrinsic phenomenon such as channel flow, partial melting, high heat flow present in the crust.
- Theoretically, M_l and M_w holds a $1:1$ relation for the continental crust. In our study, we find significant variations of M_w with respect to M_l, which may be due to the path variation. Our obtained M_0 and M_w values can be additionally utilized for the seismic hazard studies in this area.

References

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Contact Information

Email sukantaagp@iitkgp.ac.in
Email chandrani@gg.iitkgp.ac.in