

4. Discussion

The bar chart in Figure 2 indicates that the mode is between magnitude 3.0 and 3.9. This is in consonance with the calculated measure of central tendency that has mode as 3.9 for the whole data set. Also, the mean magnitude of overall for the whole distribution is 4.19 while the median is 4.1 (Table 4). These indicate that majority of the seismic events in Northeast India are mostly minor and light types and few of moderate ones.

The intraplate and plate-boundary activities and the central tendency results affirmed that Northeast India is a region of minor and light earthquakes. But this region has witnessed eighteen (18) large earthquakes and minor and moderate ones in the last one hundred years because of the collision tectonics between the Indian plate and the Eurasian plate in the north and seduction tectonics along the Indo-Myanmar range (IMR) in the east [2], [3] and [4]. The percentage compositions of the overall data are 0.03%, 38%, 53.0%, 9% and 0.44% for the 2.0-2.9, 3.0-3.9, 4.0-4.9, 5.0-5.9 and 6.0-6.9 magnitude ranges respectively (Figure 3). The standard deviation value of 0.55 in relation to the calculated mean value shows that the data have no significant spread. This means that seismic events in this area Northeast India are not witnessing any significant spread due to the fact that earthquakes occurred in shallow epicentres and other minor low depth events [1].

The constants in the Frequency-Magnitude relationship were computed to $a=6.80$ and $b=0.93$ (Figure 5). An intermediate b -value probably means that the examined region is associated with moderate seismicity and low a -value is associated low seismicity. This also shows that Northeast India is predominantly minor and light seismicity a characteristic feature of intraplate regions. The rate of seismic activity for magnitude range 2.0-2.9, 3.0-3.9 is regular and for magnitude range 4.0-4.9, 5.0-5.9 and 6.0-6.9 is irregular or fluctuating (Table 3). It therefore means that these trends may continue in future, but the probability of occurrence of great earthquake is low. However, one has to take caution because tectonic activities of deformation and uncertainties of occurrence of earthquake are not well understood.

5. Conclusion

Northeast India is generally considered a region of low and moderate seismicity. It is concluded from this study of earthquake distribution for 50years that the study area is characterized majorly by minor and light earthquakes and a few of moderate earthquakes.

However, one has to take caution because tectonic activities of deformation and uncertainties of occurrence of earthquake are not well understood. Hence, there is possibility of occurrence of large earthquakes as a result of uncertainties associated with earthquake predictions, especially in intraplate and plate-boundary regions. Therefore civil engineers and builders should follow earthquake resistant code in the design and construction of structures.

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References

- [1] Alabi, A.A., Akinyemi, O.D and Adewale, A. "Seismicity pattern in South Africa from 1986 to 2009". Earth Science Research, 2(2), 1-10, 2013
- [2] J.R. Kayal,. Earthquake source process in Northeast India: A review. Him. Geol., 17: 53-69, 1996
- [3] J.R Kayal, "Seismicity of Northeast India and surroundings – development over the past 100 years", Journal of Geophysics, 19(1): 9-34, 1998.
- [4] S.K. Sarmah,. "The probability of occurrence of a high magnitude earthquake in Northeast India. Journal. of Geophysics", 20(3): 129-135, (1999).
- [5] R.P .Tiwari, "Status of seismicity in the Northeast India and earthquakes disaster mitigation". ENVIS Bulletin: Himalayan Ecology, 10(1), 2016
- [6] BIS (2002) IS 1893–2002 (Part 1): Indian standard criteria for earthquake resistant design of structures, part 1–general provisions and buildings. Bureau of Indian Standards, New Delhi
- [7] S. C Bhatia, Ravi Kumar, M. and Gupta, H.K). "A probabilistic seismic hazard map of India and adjoining regions". Ann di Geofis 42:1153–1166, 1999
- [8] P. Talukdar. "Seismic study and spatial variation of b-vauue in Northeast India", IOSR Journal of Applied Physics, 4(3), 31-40, 2013
- [9] Evans, P., "Tectonic Framework of Assam". Jour. Geol. Soc. India, 5, 80-96, 1964
- [10] Data retrieved from ISC website: International Seismological Centre, On-line Bulletin, <http://www.isc.ac.uk>, Internatl. seis. cent., Thatcham, United Kingdom, 2013
- [11] Gutenberg, B. and Richter, C. "Seismicity of the Earth and associated phenomena". Princeton Univ. Press , Princeton , NY., 1954