ABSTRACT

Idukki dam is one of the highest arch dam in Asia (169m), situated in the state of Kerala, India, has been functioning since 1975. As a part of standard practice of multi-purpose dam projects, the seismic activity is to be recorded over a few years before the construction starts. Hence KSEBL has established three seismological observatories around the Idukki reservoir to monitor the local seismic activity around Idukki reservoir region.

According to dam safety act 2021, the instruments are upgraded and currently there are six digital type-broadband seismographs are installed at six different seismological observatories, namely i) Idukki, ii) Kulamavu, iii) Chottupara, iv) Aalady, v) Vallakadavu and vi) Meencut.

This thesis aims to determine the source parameters of local earthquakes occurring around the Idukki reservoir region. To achieve this, earthquake digital data spanning one year (January 2024 to December 2024) has been collected from the six seismological observatories. Earthquake data processing is conducted using the SEISAN software. Seismo-tectonic maps are generated using the ArcGIS, and the graphs are plotted in Python.

Determination of the local earthquake source parameters viz., seismic moment(M_0), moment magnitude (M_W) stress drop($\Delta\sigma$) and source radius (r) brings an overall understanding about the local earthquake features that can be obtained. Estimated moment magnitude (M_W) range lies between 1.1 and 3.7. The obtained relationship is $M_w = 0.58M_L+1.02$ which shows that for small local magnitudes, the moment magnitude remains above 1.0. The seismic moment value range from 6.30E+10 to 3.98E+14 Nm while the source radius varies from 113.6 to 1124 m. A linear relationship is observed between the two parameters, i.e. as the source radius increases seismic moment also increases. Stress drop value is relatively low, ranging from 0.1 to 4 bars and analyses, there is a considerable increase in the stress drop with the seismic moment. The corner frequency (f_c) and seismic moment, shows an inverse power law relationship. Hence the larger earthquakes show lower value of corner frequency and the smaller earthquakes shows the higher value of corner frequency. The attenuation relationship $Qc = Q_0f^n$ has been obtained as $Qc = 237.1 * f^{0.91}$ for the Idukki region.

The findings obtained under this study will provide a road map for the estimation of seismic hazard for the region that will assist in preparation of the emergency action plan (EAP) to mitigate the catastrophic consequences of dam failure and to reduce the huge impact on economic and social systems.

Key words: *Local seismicity, Source parameters, Idukki reservoir.*