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Coda attenuation analysis of Zagreb area, Croatia

Iva Dasovic, Marijan Herak, and Davorka Herak
University of Zagreb, Faculty of Science and Mathematics, Department of Geophysics, Zagreb, Croatia (dasovici@gfz.hr)

The area surrounding the Croatian capital Zagreb is characterised by complex faulting system as a result of compressional tectonic forces. It is situated in the transitional zone between the Alps, the Pannonian basin and the Dinarides, and exhibits a significant seismic activity. Two seismic stations (ZAG and PTJ) are set in this area of interest and recordings from these stations were used in this analysis.

In order to estimate seismic attenuation, we analysed the attenuation of coda waves. Only earthquakes with the local magnitude greater than 2.0 which occurred within 100 km from the stations were considered. Coda-Q (Q_c) was estimated using the single backscattering model, applied to seven frequency bands with central frequencies of 1.5, 3, 6, 9, 12, 18 and 24 Hz. Moreover, we also calculated Q_0 (Q_c = 1 Hz) and n that describe the frequency dependence according to $Q_c = Q_0 f^n$. Although the single backscattering model assumes there is no lapse-time dependence of Q_c, many studies have demonstrated the opposite. To explore this kind of dependence of Q_0 and n, we used a series of 30 s long time-windows along the first 50 s of the coda of an earthquake. Starting at the coda onset at twice the S-wave travel time, the time-window was shifted by one second at a time. Every estimated Q_c is associated with the lapse-time of the middle of the corresponding time-window and is accordingly distributed to classes. Both Q_0 and n exhibit notable lapse-time dependence. In general Q_0 increases with the lapse-time which indicates decrease of attenuation with the depth, whereas n decreases almost symmetrically. The values of Q_0 suggest that the area is highly heterogeneous and the values of n suggest significant frequency dependence of Q_c. These estimations are compared to the results for coastal part of Croatia.

These results will help in determination of seismic moments and quantification of small and moderate earthquakes occurring in the Zagreb area, as well as in the ongoing studies of the lithospheric structure.

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