COMPARISON OF DIFFERENT METHODOLOGIES FOR REGIONAL MAGNITUDE CALCULATION OF EURO-MEDITERRANEAN EARTHQUAKES

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ABSTRACT

Based on the data of the German Regional Seismic Network (GRSN) the reliability of several types of magnitudes in the regional distance range is investigated to derive a consistent method for a unified magnitude scale, intended to be used for a European seismic reference bulletin. As this bulletin will include many small events with body-wave magnitude below m_b 4.0, for the calibration of regional magnitude scales, variations in the source corner frequency as a function of event magnitude have to be considered to take into account non-linear relations between the magnitude scales.

For the magnitude comparison European earthquakes with tightly clustered epicenters are used as reference data set to eliminate a possible amplitude/frequency bias caused by travel path effects. For the calculation of various proposed regional magnitudes (M_L, $m_b(P_n)$, $m_b(Lg)$, log rms(Lg), M_0 based regional magnitude) only events with independent teleseismic estimates of the earthquake size are used. Results from this test of the relative performance of the different regional magnitude scales using GRSN recordings of the 1997 Umbria-Marche, central Italy, earthquake sequence will be presented.

For 38 earthquakes of the Umbria-Marche sequence three types of regional magnitudes were calculated for the GRSN station WET. The relative performance of the three different magnitude scales is evaluated by linear regression against network m_b body wave magnitudes. The standard deviation $S.D.$ and the slope S is used for assessing the reliability of the Lg based magnitudes relative to a reference magnitude set. The best result is obtained for rms m_{lg} in terms of both S and $S.D.$. However, the differences are only slight for M_L and $m_b(Lg)$.- A similar comparison was made for the three magnitudes with the M_0-values as a reference. Here the $S.D.$ values are clearly smaller, but again the rms m_{Lg} magnitude gave the best results.

Based on a method proposed by Bolt & Herrariz (1983) a calibration relation M_0- relating seismic moment and measurements (amplitude and coda decay time) from regional seismograms was calculated, using 14 earthquakes with independent seismic moments. This equation can now be used to calculate M_0 for other earthquakes of the Umbria-Marche sequence for which no seismic moment estimates exist. Additionally, results from a newly derived $m_b(P_n)$ scale for Euro-Mediterranean earthquakes and a regional comparison to results from the Western United States will be presented.