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THE 2013 EARTHQUAKES IN THE VIENNA BASIN: RESULTS FROM STRONG-MOTION AND MACROSEISMIC DATA

Helmut Hausmann[1], Rita Meurers[2] and Nikolaus Horn[3]

Seismic hazard studies generally focus on estimating ground motion in terms of peak ground acceleration (PGA) and peak ground velocity (PGV), but it's hard to find a direct correlation between these parameters and macroseismic intensity. As the relationship between ground motion and intensity is affected by many factors such as ground motion level, duration, local site conditions and building vulnerability the study of ground motion attenuation from macroseismic intensity provides a valuable constraint to ground motion models. Macroseismic intensity is based on documented earthquake effects at the surface and can be directly related to future damage scenario.

The southern Vienna Basin is one of the seismically most important regions in Austria. Since 1000 AD, fourteen earthquakes with macroseismic intensities > 7 (EMS) took place in this area. This region, including the capital Vienna, has more than 2 million inhabitants and sensitive infrastructure. Therefore seismic hazard assessment and mitigation is an important task. In autumn 2013 two stronger earthquakes with a magnitude of 4.2 followed by about 30 aftershocks occurred in the Southern Vienna Basin. The focal depths were about 12 km and the focal mechanism suggests for both events strike-slip along the Vienna Basin transfer fault. The quakes caused slightly damages to walls in many houses in the epicentral area.

We compute amplitude spectra, Arias intensity and strong-motion duration, PSA and transfer function for soil amplification to characterize and assess the impact of earthquakes in the Southern Vienna Basin. The distribution of macroseismic intensities is then compared with the recorded ground motion values. Furthermore the data is compared to a shock with a magnitude of 4.8 occurred in the year 2000. Instrumental data is provided by the strong-motion network in Vienna (six stations; Kinemetrics Episensor) and two stations close to the epicentre (Kinemetrics FBA23). The network geometry allows for comparison of rock and soil sites. The macroseismic data for the 2013 events include more than 8000 reports and were evaluated in terms of EMS-98. Thereof about 3600 reports originated from Vienna. Attenuation relations were computed with a physically based model as a function of magnitude, hypocenter depth, geometrical spreading and energy absorption.

[1] Dipl.-Ing., Central Institute for Meteorology and Geodynamics, Departement of Geophysics/Seismology, 1190 Vienna, Hohe Warte 38, helmut.hausmann@zamg.ac.at
[2] Mag., Central Institute for Meteorology and Geodynamics, Departement of Geophysics/Seismology, 1190 Vienna, Hohe Warte 38, rita.meurers@zamg.ac.at
[3] Central Institute for Meteorology and Geodynamics, Departement of Geophysics/Seismology, 1190 Vienna, Hohe Warte 38, nikolaus.horn@zamg.ac.at

The maximum recorded total acceleration was about 10 cm/s² at the closest station and 6.6 cm/s² in Vienna. The derived attenuation relation based on the strong-motion stations clearly shows the influence at the soil sites. Amplitude spectra systematically show that the event on September, 20th was slightly stronger and more broad-band. Higher spectral amplitudes can be found in a frequency range of 7-10 Hz on the Pg spectra and in the range of 4-12 Hz on the Sg spectra. For the 2013 earthquakes in the Vienna Basin we assigned an epicentral intensity of 5 to 6 (EMS-98). For Vienna we derived local intensities with values varying from 3 to 4. However, strong shaking and fall down of top-heavy or precariously supported objects were also reported by numerous people in higher floors in Vienna. The distribution of intensities exhibits a clear radiation of the energy to the northwest of the epicentre.