Geophysical Research Abstracts
Vol. 12, EGU2010-8312, 2010
EGU General Assembly 2010

A fault kinematic based assessment of Maximum Credible Earthquake magnitudes for the slow Vienna Basin Fault

Kurt Decker, Andreas Beidinger, and Esther Hintersberger
University Vienna, Department of Geological Sciences, Vienna, Austria (kurt.decker@univie.ac.at)

Assessing the maximum credible earthquake (MCE) for a specific region is an important step in seismic hazard assessment. In regions of high seismicitiy and long historic records, the possibility is relatively high that the maximum credible earthquake is included in the regional earthquake catalog. In regions with low or absent historic seismicity, however, the MCE must be determined from geological information. In the Vienna Basin, seismicity along the eastern basin margin is on a moderate level (Imax/Mmax = 8/5.2), concentrated along the left-lateral strike-slip Vienna Basin Transfer Fault (VBTF). In contrast, in the northern and western parts, as well as close to the city of Vienna, there are neither historical nor instrumental earthquake records. New paleoseismological data, however, have shown that several surface-breaking earthquakes occurred in that region during the Late Pleistocene. We consequently try to assess the earthquake potential in that region using an elaborated kinematic model of Quaternary and active faulting.

The VBTF comprises several sinistral strike-slip segments with distinct kinematic and seismotectonic properties. Seismicity along the fault highlights four major segments referred to as the Mitterndorf-Schwadorf-, Lassee-, Zohor- and Dobra Voda Segment. Unlike the Lassee Segment, which hardly released any seismic energy in historical times, the three others show abundant moderate earthquakes in the last 400 yrs. Fault mapping using 2D/3D reflection seismic, gravity, and geomorphology shows that these seismotectonically defined segments are delimited by major fault bends including a restraining bend (Dobra Voda) and three releasing bends with negative flower structures overlain by Pleistocene pull-apart basins with up to 150 m growth strata. The releasing bends are connected by non-transtensive segments. In addition to the overall geometry of the strike-slip fault with releasing / restraining bends, the transfer of displacement to several normal faults splaying from the strike-slip system appears to be an important factor controlling fault segmentation.

In order to assess MCE magnitudes for this complex tectonic setting on the background of earthquake data spanning a time of only 500 yrs (i.e., shorter than the expected recurrence times of the strongest earthquakes) we choose a deterministic approach using a 3D fault model quantifying the lengths and areas of potential rupture zones. The model accounts for kinematic fault segmentation. Fault surfaces of strike-slip segments vary from 55 km^2 to more than 400 km^2, those of the normal splay faults from 100 to 300 km^2. Empirical relations confirm that these areas are sufficiently large to create earthquakes with M=6.0-6.5. The possibility of even stronger events caused by multi-segments ruptures, however, cannot be excluded at present.

The estimated MCE magnitudes are generally in line with newly obtained paleoseismological information from one of the splay faults of the VBTF(Markgrafneusiedl Fault). Preliminary data reveal that single slip events at this fault show surface displacements up to 20 cm compatible with earthquake magnitudes $M \geq 6$. Archaeoseismological data indicating a $M \sim 6.0$-6.3 earthquake at the Lassee strike-slip segment further support the validity of our approach.