



Intensity earthquake scenario (scenario event - a damaging earthquake with higher probability of occurrence) for the city of Sofia

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Among the many kinds of natural and man-made disasters, earthquakes dominate with regard to their social and economical impact on the urban environment. Global seismic risk to earthquakes are increasing steadily as urbanization and development occupy more areas that are prone to effects of strong earthquakes. Additionally, the uncontrolled growth of mega cities in highly seismic areas around the world is often associated with the construction of seismically unsafe buildings and infrastructures, and undertaken with an insufficient knowledge of the regional seismicity peculiarities and seismic hazard. The assessment of seismic hazard and generation of earthquake scenarios is the first link in the prevention chain and the first step in the evaluation of the seismic risk. The earthquake scenarios are intended as a basic input for developing detailed earthquake damage scenarios for the cities and can be used in earthquake-safe town and infrastructure planning.

The city of Sofia is the capital of Bulgaria. It is situated in the centre of the Sofia area that is the most populated (the population is of more than 1.2 mil. inhabitants), industrial and cultural region of Bulgaria that faces considerable earthquake risk. The available historical documents prove the occurrence of destructive earthquakes during the 15th-18th centuries in the Sofia zone. In 19th century the city of Sofia has experienced two strong earthquakes: the 1818 earthquake with epicentral intensity $I_0=8-9$ MSK and the 1858 earthquake with $I_0=9-10$ MSK. During the 20th century the strongest event occurred in the vicinity of the city of Sofia is the 1917 earthquake with $M_S=5.3$ ($I_0=7-8$ MSK). Almost a century later (95 years) an earthquake of moment magnitude 5.6 ($I_0=7-8$ MSK) hit the city of Sofia, on May 22nd, 2012.

In the present study as a deterministic scenario event is considered a damaging earthquake with higher probability of occurrence that could affect the city with intensity less than or equal to VIII. The usable and realistic ground motion maps for urban areas are generated: - either from the assumption of a "reference earthquake" - or directly, showing values of macroseismic intensity generated by a damaging, real earthquake. In the study, applying deterministic approach, earthquake scenario in macroseismic intensity ("model" earthquake scenario) for the city of Sofia is generated. The deterministic "model" intensity scenario based on assumption of a "reference earthquake" is compared with a scenario based on observed macroseismic effects caused by the damaging 2012 earthquake (MW5.6). The difference between observed (I_0) and predicted (I_p) intensities values is analyzed.