Earthquakes are the most deadly natural disasters affecting the human environment; indeed, catastrophic earthquakes have marked a large part of human history. Global seismic hazard and vulnerability to earthquakes are steadily increasing as a result of uncontrolled growth of megacities in highly seismic areas around the world. It is often associated with the construction of seismically unsafe buildings and infrastructures and caused by insufficient knowledge of the regional seismicity patterns and seismic hazard. Over the centuries, Bulgaria has experienced strong earthquakes. The strongest event reached magnitude 7.8 in southeastern Bulgaria, magnitude 7.5 in northeastern Bulgaria, and magnitude 7.0 in southern Bulgaria. Moreover, the city of Sofia and the neighboring countries, like Greece, Turkey, former Yugoslavia, Romania, and Hungary, have experienced strong earthquakes including in Sofia in Figure VII. Earthquake hazard is probabilistic and includes the element of human influence; thus, it is important to consider both the natural and anthropogenic factors that influence the seismic hazard in Bulgaria. Figure I illustrates the spatial pattern of seismic hazard in Bulgaria. Figure II shows the comparison of seismic hazard in Bulgaria with the hazard of the cities of Rome and Vienna. Figure III shows the comparison of seismic hazard in Bulgaria with the hazard of the cities of Rome and Vienna.

Seismic hazard disaggregation

A procedure called disaggregation has been applied to examine the spatial and magnitude dependence of PSHA results. The aim is to determine the magnitudes and distance that contribute to the calculated exceedance frequency at a given return period and at a structural period of interest. The hazard for 27 cities on the territory of Bulgaria for a 475 years return period and PGA in partitioned into selected magnitude and distance bins (Solakov et al., 2012).

Seismic hazard scenarios

The generation of earthquake scenarios is the first link in the prediction chain and the first step in the process of seismic risk evaluation. The implementation of the earthquake scenario into the policies for seismic risk reduction will allow focusing on the prevention of probable earthquake consequences. In the framework of the EU COST 721 (2006-2009) and other programs, the earthquake scenarios have been developed to assess the regional seismic hazard. The scenarios have been used for the seismic hazard assessment and the risk estimation. The earthquake scenario consists of the most probable historical and industrial regions of Bulgaria that faces considerable earthquake risk. In 1909 the city of Sofia experienced a strong earthquake that caused heavy damage and economic losses. The earthquake scenario has been developed for the Sofia region and the hazard was used for the seismic hazard assessment. The earthquake scenario includes the historical and recent earthquakes that have occurred in the region of interest. The earthquake scenario has been developed to assess the regional seismic hazard and to assess the seismic risk in the Sofia region.

Seismic Hazard for Bulgaria

The seismic hazard is the probability that various levels of strong ground motion will be exceeded during a specified time period at a site. The ground motion levels may be expressed in terms of peak ground acceleration, velocity, displacement, and peak response spectral amplification for a range of frequencies. The analysis is often summarized with a seismic hazard curve, which shows annual probability of exceedance (or frequency of exceedance) versus ground motion amplitude. A flow chart for the main stages in probabilistic seismic hazard analysis is presented in Figure 2.

Seismic hazard maps are produced as a new building code for Bulgaria based on the recommendations in EUROCODE 8 and are generated applying probabilistic method (presented in Solakov et al., 2004). The basic approach used for the creation of ground motion maps combines GIS, source-geometrical, earthquake source and attenuation models. The PSHA was performed using the Bulgarian version of computer code EQDK3. As recommended in EU8, the maps are calculated for a 475 years return period (probability of exceedance of 10% in 50 years, presented in Figure 3) for the design earthquake and for 95 years return period (probability of exceedance of 10% in 50 years, presented in Figure 4). The seismic hazard map has been calculated for a 475 years return period (probability of exceedance of 10% in 50 years) using the probabilistic seismic hazard analysis.

The earthquake scenarios for the city of Sofia

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 more than 1.5 million inhabitants), industrial and cultural region of Bulgaria that faces considerable earthquake risk. In 1909 the city of Sofia experienced a strong earthquake that caused heavy damage and economic losses. The earthquake scenario was developed for the Sofia region and the hazard was used for the seismic hazard assessment. The earthquake scenario includes the historical and recent earthquakes that have occurred in the region of interest. The earthquake scenario has been developed to assess the regional seismic hazard and to assess the seismic risk in the Sofia region.

Seismic Hazard for Bulgaria

The seismic hazard is the probability that various levels of strong ground motion will be exceeded during a specified time period at a site. The ground motion levels may be expressed in terms of peak ground acceleration, velocity, displacement, and peak response spectral amplification for a range of frequencies. The analysis is often summarized with a seismic hazard curve, which shows annual probability of exceedance (or frequency of exceedance) versus ground motion amplitude. A flow chart for the main stages in probabilistic seismic hazard analysis is presented in Figure 2.

Seismic hazard maps are produced as a new building code for Bulgaria based on the recommendations in EUROCODE 8 and are generated applying probabilistic method (presented in Solakov et al., 2004). The basic approach used for the creation of ground motion maps combines GIS, source-geometrical, earthquake source and attenuation models. The PSHA was performed using the Bulgarian version of computer code EQDK3. As recommended in EU8, the maps are calculated for a 475 years return period (probability of exceedance of 10% in 50 years, presented in Figure 3) for the design earthquake and for 95 years return period (probability of exceedance of 10% in 50 years, presented in Figure 4). The seismic hazard map has been calculated for a 475 years return period (probability of exceedance of 10% in 50 years) using the probabilistic seismic hazard analysis.

The earthquake scenarios for the city of Sofia

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 more than 1.5 million inhabitants), industrial and cultural region of Bulgaria that faces considerable earthquake risk. In 1909 the city of Sofia experienced a strong earthquake that caused heavy damage and economic losses. The earthquake scenario was developed for the Sofia region and the hazard was used for the seismic hazard assessment. The earthquake scenario includes the historical and recent earthquakes that have occurred in the region of interest. The earthquake scenario has been developed to assess the regional seismic hazard and to assess the seismic risk in the Sofia region.