



Comprehensive Earthquake Catalogs and Seismicity Parameters from Incomplete Earthquake Catalogs of Guilan Region, Iran

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Abstract

Statistics of human losses and financial casualties in Guilan province as one of the most populated and strategic areas in the north of Iran have doubled the importance of having knowledge about earthquake and strategies to reduce its effect. In order to investigate seismic hazard analysis, earthquake records along with selecting the proper distance of intended locations were gathered to make Poissonian catalogs. The earthquake catalogs cover the geographical area limited to 35.0°-39.3°N, 47.1-52.2°E and include around 4,000 earthquake events between the years of 855 to 2016. An extensive amount of efforts and times are required to eliminate duplicated events, to unify the magnitude scales and to cluster the earthquake sequences with variable windows in time and location domains to remove aftershocks and foreshocks. The Final homogenous catalog consists of around 110 events for each region. Magnitude of completeness in different time intervals is reported for Guilan region. Seismicity parameters were achieved using Gutenberg-Richter method by Zmap and Kijko-Sellevoll approaches for important cities of Guilan including Rasht, Anzali, Rudbar, and Lahijan. Comparative analysis of the results from Zmap and Kijko-Sellevoll approaches shows good consistency in the estimation of seismic parameters with the result of literature.

Keywords: Earthquake Catalog; Seismic Parameters; Annual Rate of Exceedance; Time-Space Windows; Magnitude of Completeness.

1. Introduction

Some of the most tragic disasters of the world have been caused by an earthquake. According to United States Geological Survey earthquake facts and statistics, more than 100 earthquakes with magnitude of 6 or greater, and 10 earthquakes of magnitude 7 or greater happen each year. An earthquake measuring magnitude 6 on the Richter scale or greater, can threat many people around the world.

Iran as one of the most seismic active countries in the Middle East located over the Himalayas-Alp seismic belt. Oil fields, trade routes, geography and terrain, all contribute to the strategic importance of this region in the Middle East. Therefore, it seems crucial to investigate the activity of tectonics and seismicity of Iran. Hessami and Jamali (2006) have shown that the activity of tectonic in Iran is a significant sign of active crustal deformation, which is due to the convergence between Arabia and Eurasia plates, estimated around 2.1-2.5 cm/year [1]. In 1999, Tavakoli and Ghafory divided Iran into several seismotectonic subdivisions and reported seismicity parameters for each subdivision from earthquake catalog [2]. The Span of time for their investigation consisted of the limited range of time and not included historical events. During several past years, great amount of efforts were made in all of regions to improve the earthquake catalog features such as quality and quantity of data, completeness interval in time domain, unification of magnitude scales, and accurate determination of time and location of earthquake events. Therefore, presentation of an updated and homogeneous earthquake catalog of Guilan regions, a densely populated province in the north of Iran, was chosen as one of the primary aim of the study.

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