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# A Comprehensive Seismic Hazard Zoning of Iran

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## Preface

The Seismic hazard zoning map of Iran is published in 1976 by Berberian. The map contained the maximum possible intensity according to the known macroseismic zones of the great earthquakes in Iran. The earthquake hazard studies was followed by developing the the maps containing the iso-acceleration values for the country by Mohajer-Ashjaei. All the previous maps of Iran contains the maps that are based on the assessment of the peak accelerations using the empirical attenuation formulas developped for northern America and Europe. The present study aimed to develp for the first time the seismic hazard zoning for which the data are analyzed using the attenuation laws established by the author for Iran. The author tried to determine the seismic source zones for the using the knowledge on the strong motions records (more than 6000 three component records by the end of 2005), as well as the seismotectonic characteristics of different regions of Iran and the that are recorded now in Iran.

The seismic hazard assessments in Iran performed using two approaches (probabilistic and deterministic). The deterministic approach depends a lot to the maximal estimation of the physical input parameters, and the probabilistic approach applies the statistical models for the probabilistic assessment of return period of different strong motion parameters. The assessment of values of input parameters (Mmax, distance to the seismic source and the site conditions) and the selection of the attenuation models

to evaluate the seismic hazard parameters contains different amounts of uncertainties. The Mmax is estimated based on the maximum observed earthquake; assessment of maximum probable earthquake for a seismic source and application of the empirical relationships between the magnitude and fault-length and/or width. The distances to the seismic source are defined as the direct surface distance to the fault; distance to the seismogenic depth and focal distance to the source.

The areas existing in the near-fault conditions need to be investigated specifically because of the important vertical motions experienced in such area according to the directivity effects, as well as the possibility of direct fault rupturing. Such conditions might not be revealed in the regional seismic hazard mapping and need specific case studies.

The site conditions are classified mostly based on the seismic codes in 4 to 6 orders of site conditions, however the real site conditions are sometimes different than that is concerned as the definition of the site class. This might correspond to the depth of the alluvial deposits and to shear wave velocities corresponding to different parts of the alluviums.

The attenuation models are mostly used without any reference to the seismotectonic and seismicity conditions of the region for which the attenuation model is developed. These relationships contain themselves different levels of standard deviations.

This paper tries to consider different sources of uncertainties in the mentioned inputs of the seismic hazard studies and the empirical models that are usually applied in this regard.

A logic tree algorithm is used in order to imply these different uncertainties. The case studies are used in order to explain the method of implication of uncertainties.

Conclusions

Based on the performed case studies; it has been revealed that the "expert opinion" has an essential roll in order to synthesis these various sources of uncertainties. On the other hand, in the regions where the strong motions are already recorded and more data are available, the decision making is easier than the region that the strong motions are sparsely recorded. This problem can be explained in the region of Zagros in which most of recorded strong motions in Iran are obtained (based on its higher seismicity) in comparison to the eastern and southeastern Iran. This study showed that the news probabilistic seismic hazard analysis for Iran gives greater PGA values of in the Alborz-Central Iran, specially in the case of the near-field data. These condition might be even seen in the central Zagros region. The southwestern parts of the country still show the lowest seismic hazard levels (specially in the Khuzestan plain).