ASSESSMENT OF GMPES FOR IRANIAN DATABASE BY EMPLOYING LLH AND EDR METHODS

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The selection of Ground Motion Prediction Equation (GMPE) is one of the key elements in the seismic hazard analysis specifically for high seismic zones such as Iran plateau. Therefore, the comprehensive assessment of a set of GMPEs is done in this paper based on the two new emerged methodologies i.e. log-likelihood based ranking method (LLH) (Scherbaum et al., 2009) and Euclidean-Distance Based Ranking method (EDR) (Kale and Akkar, 2013).

The LLH method, which is an information-theoretic model selection approach, is based on log-likelihood approach to measure the distance between two continuous probability density functions f(x) and g(x). The quantitative decision favouring different candidate models requires a meaningful measure to recognize candidate probabilistic models. Within an information theory framework, this measure is given by the Kullback-Leibler distance (Delavand et al., 2009).

Lately, EDR method that is developed by Kale and Akkar (2012) proposes an alternative ground-motion model selection and ranking procedure. This method is based on Euclidean distance (DE) definition. It is worth noting that this approach accounts for the influence of sigma on the estimated ground-motion data and existing trend between observed data and median estimations of predictive models.

In this study, the ground motion database consists of 485 records out of 84 seismic events which were recorded between from 1978 to 2013 is used to assess the nominated attenuation relationships. The magnitude range is between 5 to 7.4 and the distance is less than 100 km (BHRC, 2013). Four GMPE categories are examined in this paper which are: (1) The local GMPE models which are developed based on Iranian events, (2) Regional models which are for Europe and Asia, (3) The NGA-WEST1 GMPE models (Power et al., 2008), and (4) The NGA-WEST2 GMPE models (Bozorgnia et al., 2014). The analysis is performed for spectral accelerations corresponding to the eight periods (T = 0.0, 0.1, 0.2, 0.5, 0.75, 1.0, 1.5, and 2.0 sec). The obtained results are, respectively, shown in Figure 1(a) and Figure 1(b) in the case of LLH and EDR.

Additionally, in order to rank the GMPEs, the mean LLH and mean EDR are calculated for all the considered periods. These results are shown in Table 1 which indicates significant difference between the two considered methods. The Zetal12 and Getal09 GMPEs have the best performance based on the LLH method whereas the BSSA14 and CY08 GMPEs are the best cases based on the EDR method.

A more detailed look at Figure 1(a) proves that Getal09 and Zetal12 for all the nominated period ranges have smaller LLH in comparison the other GMPEs and display better compatibility among the other models. While, in Figure 1(b) For instance, Zetal12 GMPE model in short periods (T=0.0, 0.1, 0.2 sec) represents lower rank among the other models. In contrast, for moderate and longer periods (T = 0.75, 1.0, 1.5, and 2.0 sec) shows better ranking in comparison to the other models. Also Figure 1(b) shows the similar trend between most of the candidate GMPEs models. Therefore, in this paper the final ranking and selecting of the GMPEs models is based on the LLH approach.

As a final result, Getal09 and Zetal12 both from Iranian GMPEs category are nominated as the best models for Iranian database based on the LLH method. Additionally, AC10, KG04, Sharma and CB08 GMPEs are not appropriate GMPEs model for the Iranian seismic zone based on the two mentioned methods.

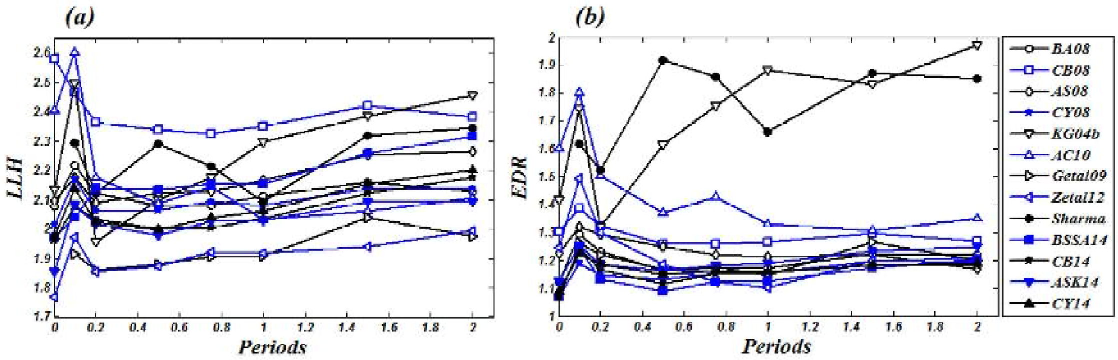

Figure 1. (a) The LLH index (b) The EDR index versus period for different GMPEs

Table 1. The GMPE ranking based on the LLH and EDR criteria

Model	LLH	Model	EDR
Zetal12	1.90	BSSA14	1.14
Getal09	1.93	CY08	1.16
ASK14	2.02	CB14	1.16
CB14	2.05	CY14	1.17
CY14	2.07	ASK14	1.20
CY08	2.09	BA08	1.20
BA08	2.12	Getal09	1.21
BSSA14	2.14	Zetal12	1.23
AS08	2.16	AS08	1.24
AC10	2.20	CB08	1.30
KG04b	2.25	AC10	1.46
Sharma	2.27	KG04b	1.69
CB08	2.40	Sharma	1.75

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