The Ground Motion Prediction Equations (GMPEs) take a very strong contribution to the PSHA. In the last decades, hundreds of new these attenuation laws have been produced and published in literature. The primary objective of PSHA is to understand the capabilities and the related performances of GMPEs. Moreover, it is not straightforward to establish the right GMPE to apply in a specific region with specific geological and geophysical conditions. In order to respond to need to apply GMPEs showing the better performances in PSHA, we tried to develop an objective procedure that select and rank the GMPEs. At last, we built a Model Ensemble merging the scored GMPEs by using objective weights associated to each GMPE.

We choose to associate an objective weight to each GMPE model pre-selected (1) based on the loglikelihood (LL) concept (Good, 1952). Here $l_k$ is the log-likelihood scored by the k-th GMPE. The scheme of equation (1) may be understood as the weighted average of the probabilities given by the GMPEs, respectively. The average of the distribution is the best guess for the probability of ground shaking, i.e., the probability given by GMPE; the variance is a measure of the epistemic uncertainty due to the presence in general of differences between GMPEs (Marpunz et al., 2014).

$$\omega_i \propto 1/l_k$$

$$c_0 = 1/BICE_i$$

$$\xi (\theta) = \frac{1}{\alpha + \beta}$$

$$\text{val}(\theta) = \frac{\alpha}{(\alpha + \beta)(\alpha + \beta + 1)}$$

We investigate their different forecasting performances in relation to the sites, Focal Mechanisms and their combinations

Akkar & Bommer (2010)

Bindi et al. (2011)

Cauzzi & Faccoli (2008)

Figure 3: Comparison of selection and ranking

We weight and rank a set of GMPEs for Italy and Japan with a method based on LL concept

We investigated their different forecasting performances in relation to the sites, Focal Mechanisms and their combinations

We found that there is a minor role of Zonation for GMPEs

We noted differences between the response of Italian and Japanese dataset; Cauzzi & Faccoli (2008) presented the best performances both for Italy and Japan even if calibrated on Japanese data. Counter, the Bindi et al. (2011) model calibrated on Italian data presented an opposite behavior

We realized Ensemble Models for GMPEs in Italy and Japan investigating the forecasting performances

Table 1: Numbers associated with combinations of sites used for BICE computation of each GMPE

From k-NET, the Japanese strong-motion seismograph network (http://www.fukushihitachi.ejrb.affrc.go.jp), we extracted the horizontal PGA (cm/s$^2$), velocity profiles (that we classified in base of the EICB; European Committee for Standardization, CEN-2004), localizations, epicentral and focal distances. We associated to each focal mechanism (Normal Fault; NF; Fault-Corner Feature Fault; FC; Strike-Slip Fault, SS) a number of sites: A (173), B (113), C (565), D (25), E (2), F (1). For all these sites, we computed epicentral and focal distances. We associated to each mechanism (Normal Fault; NF; Reverse Fault, RF; Strike-Slip Fault, SS) a number of sites: A (610), B (365), C (25), for 79 hypocenters. The total number of data is 313. The range of distances and magnitudes in Fig.(A)

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From ITACA-1.1, the Italian accelerometric Archieves (http://ita-ca.mi.ingv.it/ItacaNet/) (Lucit, 2010), Bindi et al. (2010) have pre-selected (i) the horizontal PGA (cm/s$^2$), strike type (EICB), Italian Committee for Standardization, CEN-2004, localizations, epicentral and focal distances. We associated to each focal mechanism (Normal Fault, NF; Reverse Fault, RF; Strike-Slip Fault, SS) a number of sites: A (173), B (113), C (565), D (25), E (2), F (1). The range of distances and magnitudes in Fig.(A)

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References: Akkar and Bommer (2009), Bindi et al. (2010), Luzi et al. (2008); Pacor and Marzocchi (2010); Pepiter et al. (2010), Marzocchi and Cauzzi (2008); Marzocchi et al. (2011).