**Supplementary information**

The SS-GMPE was constructed based on the equation (1) of Boore *et al.* (2014) (equation S1) as well as Eq. 2. We performed linear regression analysis using the least-squares method for the pseudo-spectral acceleration of events 2 through 7 (Table 1) with different *M*w (equation S2).

ln *Y* = *F*E (**M**, *mech*) + *F*P (*R*JB, **M**, *region*) + *F*S (*V*S30, *R*JB, **M**, *z*1) (S1)

where *F*E, *F*P, and *F*S represent functions for source, path, and site effects, respectively. The predictor variables are **M**, *mech*, *R*JB (in km), *V*S30 (in m/s), and *z*1 (in km). *Y* is the predicted 5% damped pseudo-spectral acceleration (*Y* in cm/s2).

*a M*w *+ c*i = In *Obsi* - *F*P (*R*JB, *M*w, *region*) (S2)

where *Obs*i, *R*JB are the same parameters as in equation (1), and *i* indicates the number of observation sites (1 to 8). We thus obtain regression coefficients *a* for the source term and *c*ifor each site condition term. *F*P is the same as the equation (3), (4) of Boore *et al.* (2014). The regional coefficient *Δc* is used the default value of 0.0.

Fig. S1 shows obtained regression coefficients *a* for the source term and *c*i for each site condition term. Additionally, we performed linear regression analysis using the least-squares method for the coefficient *c* of each site with the bedrock depth at each site in shown as equation (S3).

*c* = *pD*3200 + *q* (*T* = 1 – 10 seconds) (S3)

where *p* and *q* are the regression coefficient, *c* is the coefficient of a GMPE applicable to the whole Kathmandu Valley, and *D*3200 is the top of the bedrock depth at each site (*D*3200 in m). Fig. S2 shows the comparison of the proposed GMPEs.

**Supplementary file**

**Data 1 D3200.dat**

Top of the bedrock data (*V*s = 3200 m/s) in the Kathmandu Valley by Bijukchhen (2018)

**Data 2 Model1\_SSGMPE\_coeffs.dat (Table 2, Fig. 6)**

Coefficients *a* and *ci* of SS-GMPE (Model 1) based on Morikawa and Fujiwara (2013)

**Data 3 Model1\_c\_coeffs.dat (Table 3, Fig. 7)**

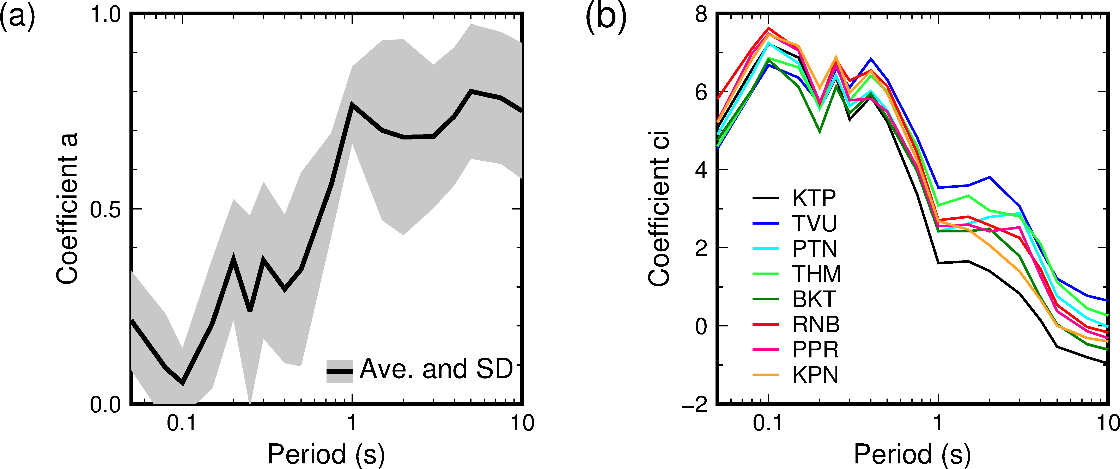
Coefficients *c* for model 1

**Data 4 SSGMPE\_model2\_coeffs.dat (Fig. S1)**

Coefficients *a* and *ci* of SS-GMPE (Model 2) based on Boore *et al.* (2014)

**Data 5 Model1\_c\_coeffs.dat**

Coefficients *c* for model 2



**Fig. S1** (a) Average values of the regression coefficient *a*. Error bars indicate standard deviations. (b) Constructed coefficient *ci* at each site.



**Fig. S2** Observed velocity response spectra for Mw 7.3 event and predicted values calculated on equation S2, S3 (Model 2) as well as the residuals (log [pre/obs]).