SECOND EUROPEAN CONFERENCE ON EARTHQUAKE ENGINEERING
AND SEISMOLOGY, ISTANBUL AUG. 25-29, 2014

A COMPARATIVE ANALYSIS OF SHARE AND SED RESPONSE SPECTRAL AMPLIFICATION MODELS

Valerio POGGI[1], Benjamin EDWARDS[2] and Donat FÄH[3]

In the framework of the Seismic Hazard Harmonization in Europe (SHARE) project, the Swiss Seismological Service (SED) was requested to perform a preliminary evaluation of the procedures developed by Aristotle University Thessaloniki (AUTH) and Middle East Technical University (METU) to produce amplification functions for 5% damped pseudo-spectral acceleration response spectra. The goal of the work presented here is to evaluate the statistical consistency of the two proposed methods, with particular regard to their applicability to engineering practice. Additionally, we compared the results from AUTH and METU with those from a methodology internally developed by the SED (Poggi et al. 2012), which makes use of the quarter-wavelength parameters to achieve the same goal.

For the comparison, a log-residual analysis was performed between the computed amplification functions from the three different methodologies, over a number of selected test sites spanning different soil classes and ground motion levels (e.g. Figure 1). The analysis of the average log-residuals of these functions is useful to highlight the main differences between the proposed approaches, with special regard to the impact of resonance and attenuation on the different frequency bands.

E) Vs30 = 279m/s, Class C2 F) Vs30 = 1387m/s, Class A

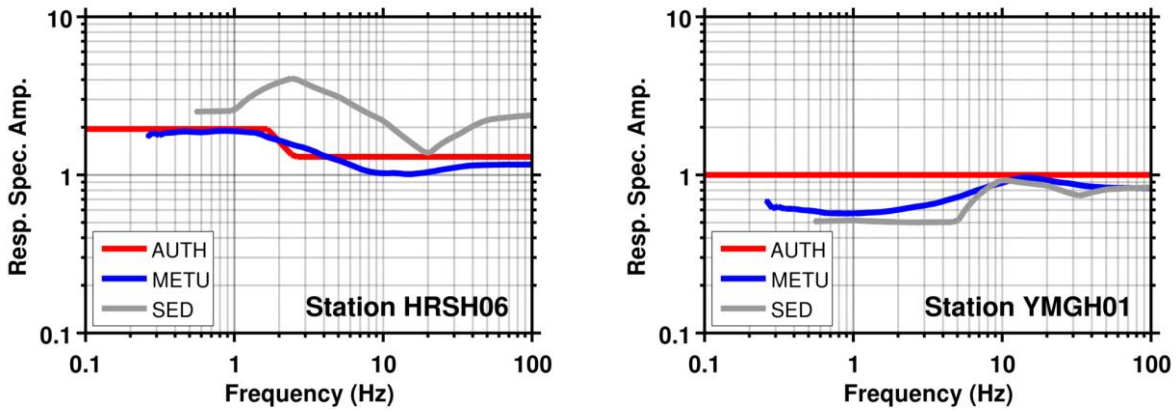

Figure 1. Examples of comparison between AUTH, METU and SED response spectral amplification at two test sites of different characteristics.

[1] Swiss Seismological Service, ETH Zurich, poggi@sed.ethz.ch
[2] Swiss Seismological Service, ETH Zurich, edwards@sed.ethz.ch
[3] Swiss Seismological Service, ETH Zurich, faeh@sed.ethz.ch

When comparing average SED and SHARE response amplification functions, however, difference in the ground motion reference conditions has to be accounted for. Practically, the SHARE amplification functions (from AUTH and METU) have been computed for different rock reference with respect to the SED model (Poggi et al. 2013). Not accounting for the difference in the reference would lead to a certain offset in the distribution of the amplification residuals (Edwards et al. 2013). The comparison was then performed by first adjusting the amplification functions for a common reference, which is here the SHARE rock reference profile.

The assessment was performed on a group of 88 selected stations of the Japanese KiKNet strong motion network, for which complete logs of the shear-wave velocity profiles are available, in addition to a significant number of earthquake recordings. In a first step, average residuals were computed from all the available 88 sites. The selection covers a wide range of Vs30 values between 100 and 800m/s. Subsequently, variability on soil classes was investigated. The target of this second step was therefore to perform the comparison by separately analyzing the impact of different soil and velocity classes, according to the classification scheme proposed by AUTH. Moreover, to generalize the analysis to a broader earthquake scenario, response spectral amplification functions have been averaged over a range of source-path parameters (magnitude, stress drop, distance, see Table 1).

Table 1. Ranges of the parameters used for the stochastic modelling of response spectra

Parameter	Range
Magnitude (M_w)	4, 5, 6
Joyner-BooreDistance (R_{JB})	10, 20, 30, 50 Km
HypocentralDepth (D)	12 Km
Fault Model	Wells and Coppersmith (1994) Strike-Slip with 79 degree dip
Attenuation Model	Edwards et al. (2011)
Stress drop (S)	60, 90, 120 bars

However, we noted relatively limited impact of the choice of individual parameter combinations due to the fact that a ratio is taken between amplified and reference spectra with identical input parameters. For the comparison with AUTH and METU results, all response spectral amplification functions obtained from these input parameter combinations were averaged (in log-statistics) to produce mean site-related models (e.g. Figure 2)

REFERENCES

Edwards B, Michel C, Poggi V, Fäh D (2013) "Determination of Site Amplification from Regional Seismicity: Application to the Swiss National Seismic Networks", *Seismological Research Letters*, (84)4:611-621

Poggi V, Edwards B, Fäh D (2012) "The quarter-wavelength average velocity: a review of some past and recent application developments", *Proceedings of the 15th WCEE*, Lisbon, Portugal

Poggi V, Edwards B, Fäh D (2013) "Reference S-wave velocity profile and attenuation models for ground motion prediction equations: application to Japan". *Bulletin of the Seismological Society of America.* (103)5:2645-2656

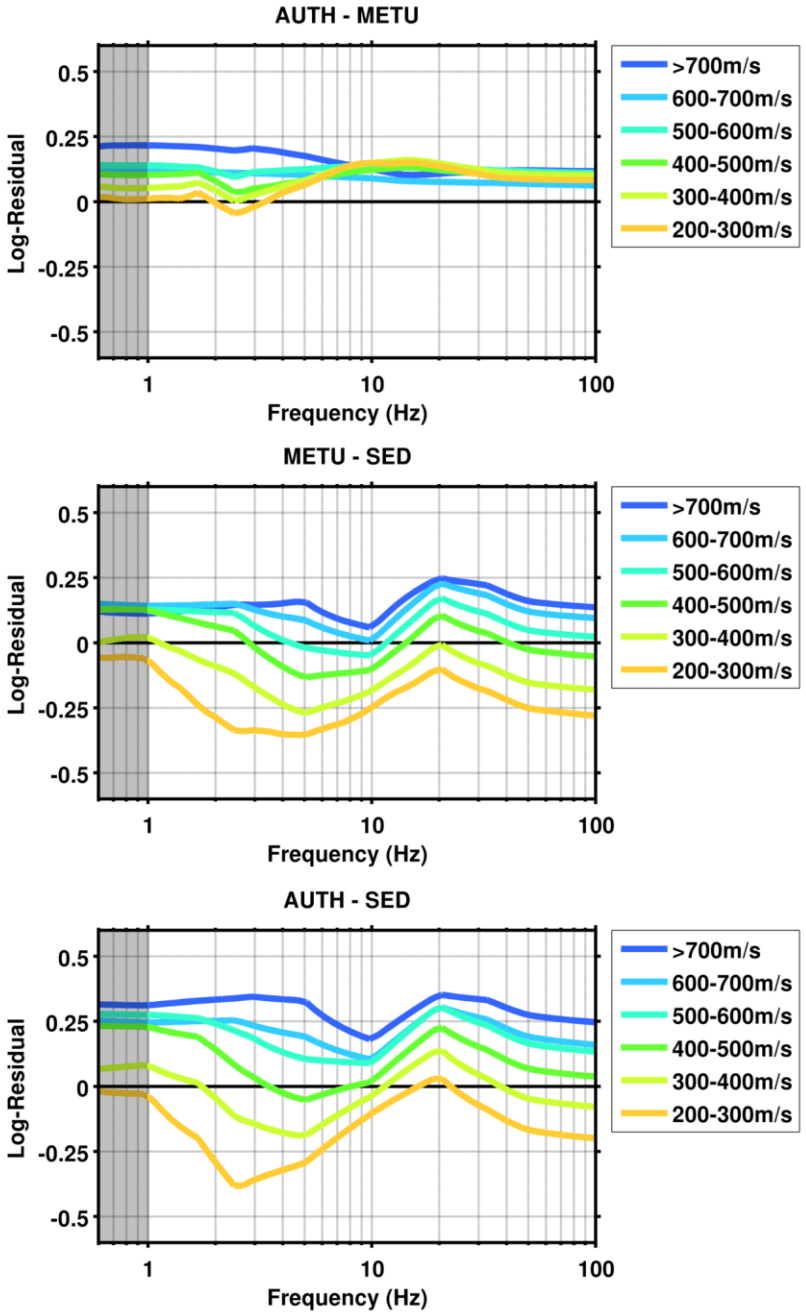

Figure 2. Variability on the average log-difference between AUTH, METU and SED models with respect to different Vs30 ranges. The gray area below 1Hz indicates the region where the statistic might be biased by lack of sufficient data points.