1. Introduction

Site response models are associated with large uncertainties and sometimes poorly capture observed ground motions. This study seeks to better understand site response models through a physical insights into site behavior.

2. Statistical results

In the aggregate, all 1D site response models (L, EQL, and NL) are biased towards underestimating ground motions at higher frequencies. Because nonlinear effects are stronger, however, these biases are smaller for the NL model based on the depth-dependent gradient than the smaller the NL bias (Fig. 1, Table 1).

3. Physical adjustments to profiles and material parameters

Hypothesis 1: Apply a depth-dependent gradient for surficial layers.

Table 1: Model biases for whole dataset and selected locations.

<table>
<thead>
<tr>
<th>Site</th>
<th>Mean Bias (%)</th>
<th>Median Bias (%)</th>
<th>Max Bias (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>-12.6</td>
<td>-10.0</td>
<td>-25.0</td>
</tr>
<tr>
<td>EQL</td>
<td>-13.0</td>
<td>-11.0</td>
<td>-27.0</td>
</tr>
<tr>
<td>NL</td>
<td>-12.6</td>
<td>-10.0</td>
<td>-25.0</td>
</tr>
</tbody>
</table>

Hypothesis 2: Randomize the measurements to create unbiased profiles.

4. Conclusions

- All models are shown to exhibit positive bias (underprediction) at short periods, particularly for small-strain motions.

5. References

- Kaklamanos et al. (2013), which analyzed L and EQL site response models at 100 KiK-net sites, and Kaklamanos and Bradley (2015), which analyzed the L, EQL, and NL model residuals at 114 sites.
- In general, the randomized profiles do not present a significant improvement from the original profile (Fig. 4). However, this approach does reduce the bias near the site period. Overall this approach might work better for other sites that are known to be more heterogeneous.

6. Acknowledgments

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