Uncertainty in the Boore et al. (2021) SoF coefficients and comparison to relative differences in GMIMs for NS and SS, RS earthquakes.

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The Boore et al. (2021) (Bea21) ground-motion prediction model (GMPM) for Greece was constructed from a mixed-effects analysis of the difference between the Greek ground-motion intensity measures and predictions from the Boore et al. (2014) GMPM (BSSA14). The within- and between-event residuals guided the adjustment of the coefficients of the GMPM for Greece, in a lengthy iterative process described in Bea21. Focusing on the style-of-faulting (SoF) coefficients $e1$, $e2$, and $e3$ (for SS, NS, and RS faults, respectively), the between-event residuals for each SoF were plotted vs. period. These plots showed the residuals to generally be small, indicating that the Greek data are in good agreement with the BSSA14 SoF coefficients. The plots of the residuals vs. period, however, had undesireable variations. A combination of objective and subjective smoothing procedures was used to adjust the SoF coefficients, the mixed-effects analysis was rerun with the new coefficients, and the resulting between-event residuals were again plotted to see if further adjustments to the SoF coefficients were needed. The procedure was repeated several times. The discussion of this process in Bea21 was brief, and the only figure showing the SoF coefficients (Figure 8 in Bea21) was plotted at a scale that made it difficult to see the small differences in the Greek and BSSA14 coefficients. In these notes I show a figure (Figure 1) that better illustrates the uncertainty in the Bea21 SoF coefficients, and how that uncertainty compares to the predicted differences in GMIMs from SS, NS, and RS faults.
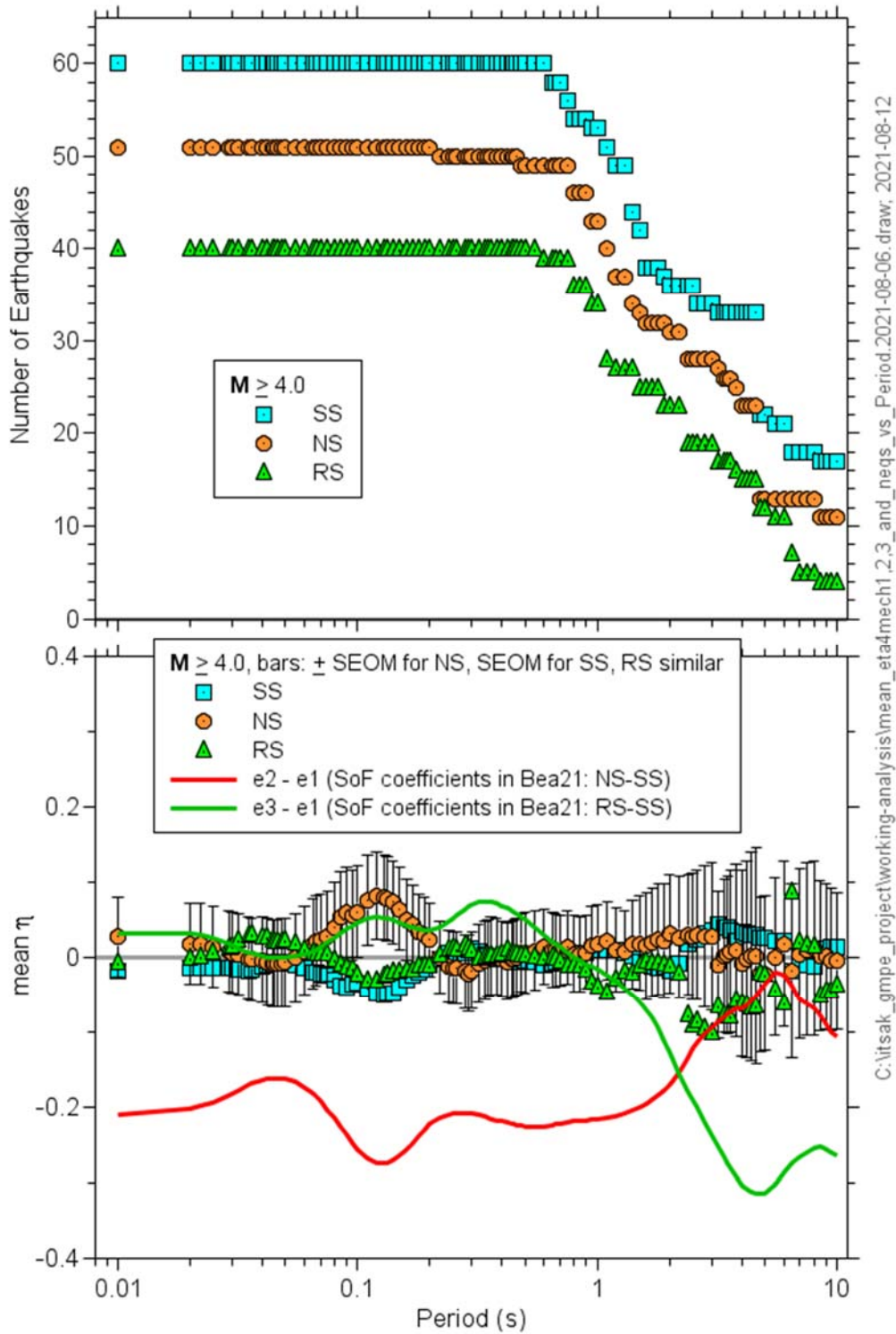
Figure 1. The ordinate scale in the lower graph is in terms of natural (base e) logarithms.

The number of events for each mech and period is shown in the top graph of Figure 1. The bottom graph shows the mean of the between-event residuals over all events with a specified mechanism (SS. NS, or RS), as a function of period. These means provide an indication of how well the GMPM predicts the Greek GMIMs for earthquakes with different mechanisms. Note that the mixed-effects analysis results in the mean of the between-event residuals over all events, irrespective of mechanism, to be 0.0 for each period. For this reason, the oscillations in the means for each mechanism in the lower graph of Figure 1 tend to mirror each other (e.g., near 0.1 s).

The difference in GMIMs for NS relative to SS (given by $\exp(e2 - e1)$) is larger than the mean between-event residuals except at longer periods. This suggests that for periods less than about 2 s, motions from NS events in Greece are less than for SS or RS events, and that this difference is greater than the uncertainty in the SoF coefficients.