

**Goodness-of-fit Criteria for Broadband Synthetic Seismograms, With Application
to the 2008 Mw5.4 Chino Hills, CA, Earthquake**

John E. Mayhew and Kim B. Olsen

San Diego State University

Dept of Geological Sciences, GMCS 231

5500 Campanile Dr, San Diego, CA 92182

Electronic Supplement (Supplementary Waveform Plots):

<http://www-rohan.sdsu.edu/~mayhew/E-Supp/BSSA-B-00-00000-esupp.html>

Abstract

We present a goodness-of-fit measure for broadband ground motion time histories. As is the case with the goodness-of-fit measure proposed by Anderson (2004), our method includes a set of user-weighted metrics such as peak ground motions, response spectrum, the Fourier spectrum, cross correlation, and energy release measures. The scale for the goodness-of-fit ranges from near 0 to 100 (perfect fit). We apply the method to broadband (0-10Hz) synthetic seismograms for the 2008 M_w 5.4 Chino Hills, CA, earthquake, generated by combining a deterministic low-frequency simulation and high-frequency scattering functions at 33 strong-motion recording sites. We find generally favorable average long-period GOF_MO values for the event, in agreement with the waveform fits. Of particular importance, relatively good fits obtained in the Chino basin provide some confidence in the strong wave-guide effects from this area obtained for scenarios of northwestward-propagating ruptures on the southern San Andreas fault (TeraShake, ShakeOut). At shorter periods, the goodness-of-fits fall above our general (ad-hoc) acceptance level at about 2/3 of the selected sites for the event. An additional metric with specific interest for structural engineers, the ratios of inelastic versus elastic displacements, is also included in our method. We find an overall goodness-of-fit level for these ratios similar to that obtained from the average set of metrics for the event. Our results suggest that the accuracy of broadband scenario simulations for greater Los Angeles is entering the range required for structural engineering applications, with some room for improvement.