Quantitative misfit criteria for comparison of seismograms

M. Kristekova (1), J. Kristek (2), P. Moczo (2), S. M. Day (3)

(1) Slovak Academy of Sciences, Bratislava, Slovakia, (2) Comenius University, Bratislava, Slovakia, (3) San Diego State University, San Diego, USA

Quantitative misfit criteria for comparison of seismograms have been developed and numerically tested. The misfit criteria are based on the time-frequency representation of the seismograms obtained as the continuous wavelet transform with the analyzing Morlet wavelet. The criteria include time-frequency envelope and phase misfits, time-dependent envelope and phase misfits, frequency-dependent envelope and phase misfits, and single-valued envelope and phase misfits.

The misfit criteria were tested using canonical signals. The canonical signals, taken as the reference signals, were specifically amplitude, phase-shift, time-shift, and frequency modified in order to demonstrate the ability of the misfit criteria to properly quantify the misfits and recognize the character and cause of the misfits between the reference and modified signals. In all cases the misfit criteria properly quantified and characterized the misfits.

The misfit criteria were also calculated for four different numerical solutions for the SCEC LOH.3 Problem (a single layer over halfspace) and the reference FK solution. The misfit criteria provided useful insight into the misfits between individual numerical solutions and the reference solution.

The standard RMS (root-mean-square) misfit matches the single-valued envelope misfit only in the case of a pure amplitude modification of the signal. In all other cases RMS considerably overestimates the misfits and does not characterize them.

The misfit criteria will be used for evaluation and comparison of solutions within the SPICE Code Validation.