Robust measurements of corner frequency, t* and site effect: the iterative cluster event method

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Seismic attenuation accompanying the velocity structures demonstrates the variations of the physical and chemical properties of the earth. The t* measurement using the seismic body wave spectrum, however, typically encounters the trade-off of corner frequency, t*, and site effect. Ko et al, [2012] proposed the cluster event method (CEM) that reduced the model parameter numbers by grouping the spatial-closed enough events for those traveling to each station along the adjacent paths and sharing one t*. Yet, the site effects among different stations collected in the same cluster bring the challenges on fitting all spectrum. We adapt the cluster strategy to group multiple nearby events recorded by one station only. Moreover, the new iterative CEM algorithm includes both the spectrum and spectral ratio data which provide constraints on seismic moments and corner frequencies of each earthquake inside the cluster, respectively. The final t* and corner frequencies are determined again by including the side effects which are averaging from spectrum residuals in the initial CEM stage. We applied the iterative CEM for earthquakes recorded at dense deployed F-net and Hi-net by NIED in the Tohoku area, Japan. The multitaper spectrums are retrieved from direct P waves with coda wavetrains tapered. Combining the spectral ratio and spectrum data with proper weightings, our new approach increases the stability of t* measurements contributed from better constrains on the corner frequency estimations.