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Imaging the Earthquake Rupture Process at High Frequencies by backprojecting local strong motion records

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The seismic source spatiotemporal rupture process of events in Japan, Taiwan and Greece are imaged by backprojection of strong motion waveforms. Normalized high frequency (>2Hz) S-waveforms from recordings on dense strong-motion networks are used to scan a predefined 3D source volume over time.
Backprojection is an alternative novel approach to image the spatiotemporal earthquake rupture. The method was firstly applied for large earthquakes at teleseismic distances but is nowadays used at local distances and higher frequencies. The greatest advantage of the method is that processing is done without any a-priori constraints on the geometry, dimension and size of the source. Thus, the spatiotemporal imaging of the rupture is feasible in higher frequencies (> 1Hz) than conventional source inversion studies even when the examined fault geometry is complex. This high frequency energy emitted during an earthquake is of great importance in seismic hazard assessment for certain critical infrastructures. The actual challenge in using high frequency local records is to distinguish the local site effects from the true earthquake source content. Otherwise, mapping them incorrectly to the source area limits the resolvability of the method. The real challenge is to remove the site effect part from all available records, or at least, to distinguish quantitatively good reference stations from hard-soil and rock sites. In this study, the advantages and limitation of the method are explored using waveform data from well recorded events in Japan (Hokkaido Eastern Iburi Earthquake, 2018, Kumamoto 7.1 Mw, 2016), Taiwan (Hualien 6.4 Mw, 2018) and Greece (Zakinthos 6.8 Mw, 2018).