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2004 M6.0 Parkfield earthquake characterization using Time Reversal

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Time reversal has proved to be a robust source location method in acoustics and is now being developed for a number of seismic applications. One problem of particular interest is locating sources where the signal-to-noise ratio is small. These include small earthquakes (<M5.5) or atypical seismic sources with a small seismic energy radiation (e.g., tremor, slow earthquakes). Time reversal has been shown to be very robust and work in the presence of poor data, low signal to noise ratio, etc. We present a prototype study showing the power of time reversal, using seismic data from the 2004 M6.0 Parkfield earthquake, which is the world's best recorded event to date and thus one of the most studied. The back-propagation of recorded seismic data in a 3D Earth velocity model is numerically carried out. We show that the reconstructed reverse wave-field exhibits clear focusing at the source point but also displays a four-lobe radiation pattern for each type of rebroadcast waves (body, surface), which is consistent with the known source mechanism: a right-lateral strike slip along the almost-vertical San Andrea fault.