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A New Characteristic Function for Fast Time-Reverse Seismic Event Location

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Microseismicity produced by natural activities is usually characterized by low signal-to-noise ratio and huge amount of data as recording is conducted for a long period of time. Locating microseismic events is preferably carried out using migration-based methods such as time-reverse modeling (TRM). The original TRM is based on backpropagating the wavefield from the receiver down to the source location. Alternatively, we are using a characteristic function (CF) derived from the measured wavefield as input for the TRM. The motivation for such a strategy is to avoid undesired contributions from secondary arrivals which may generate artifacts in the final images. In this presentation, we introduce a new CF as input for TRM method. To obtain this CF, initially we apply kurtosis-based automatic onset detection and convolution with a given wavelet. The convolution with low frequency wavelets allows us to conduct time-reverse modeling using coarser sampling hence it will reduce computing time. We apply the method to locate seismic events measured along an active part of the Sumatra Fault around the Tarutung pull-apart basin (North Sumatra, Indonesia). The results show that seismic events are well-determined since they are concentrated along the Sumatran fault. Internal details of the Tarutung basin structure could be derived. Our results are consistent with those obtained from inversion of manually picked travel time data.