Towards quasi-automated estimates of directivity and related source properties of small to moderate earthquakes with second seismic moments

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We develop a method for quasi-automated estimation of directivity, rupture area, duration, and centroid velocity of earthquakes with second seismic moments. The method is applied to small to moderate earthquakes in southern California. P and S phase picks are given by an automated picking algorithm with a 1-D velocity model and cataloged event locations. These are refined for deconvolution using a grid search on zero-crossings within a short time window around the automated P/S picks. Source Time Functions (STFs) of target events are derived using deconvolution with a stacked empirical Green's function (seGf). The use of seGf suppresses non-generic source effects such as directivity in individual eGf's. The seGf for each target event is based on stacking individual eGfs (normalized by seismic potencies) selected by spatial and magnitude criteria as well as performances in the projected Landweber deconvolution. A weighted stack of eGfs, with weight coefficients grid searched and determined by waveform fits, helps further to correct inaccuracies of focal mechanisms. Compared with a single eGf, analysis with a weighted stack can significantly improve waveform fit and typically allows getting STFs at 5-10 more stations. The method is suitable for analysis of large seismic datasets and it works for target events in southern California with magnitudes as small as 3.5. Results are generally consistent with the prediction of dynamic rupture on a bimaterial interface and the imaged velocity contrast in the study area. Updated results will be presented in the meeting.

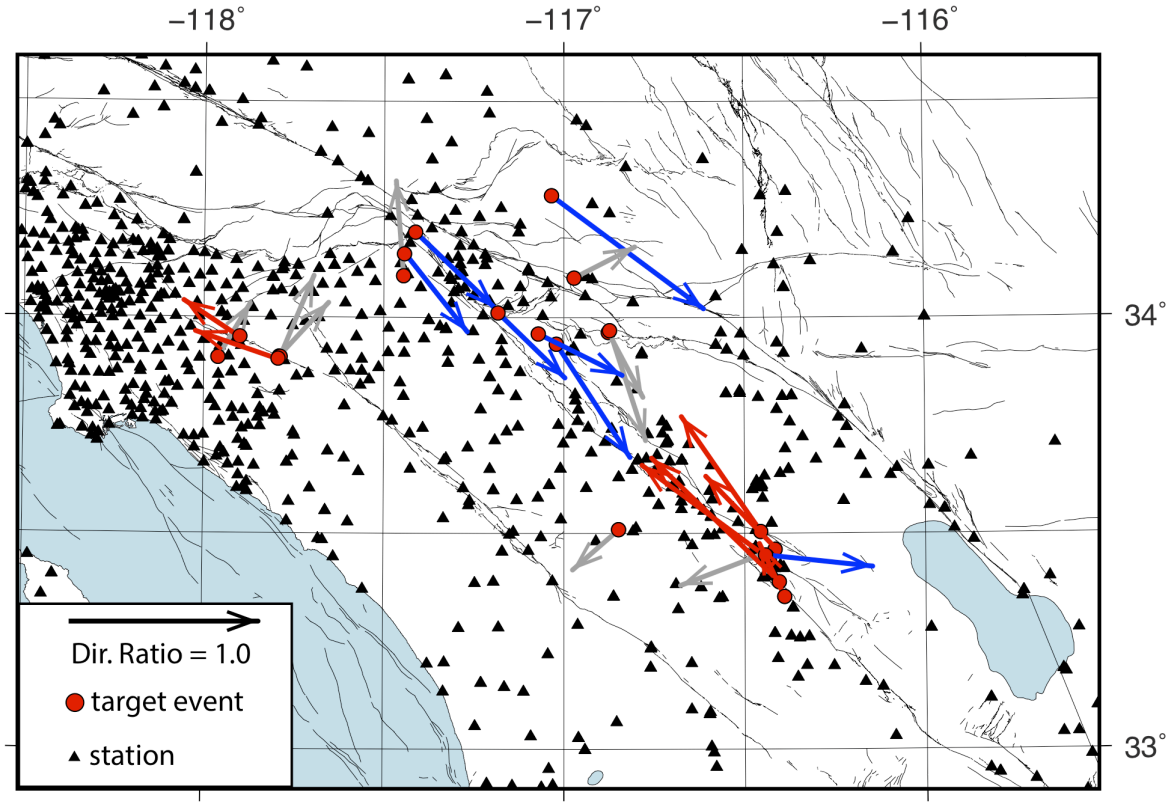

Figure 1. Directivities in horizontal directions for 24 small to moderate earthquakes in Southern California.