Repeating Seismic Events in China

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About 10% of seismic events in and near China, from 1985 to 2000, were repeating events not more than about 1 kilometer from each other. We cross correlate seismograms from ~14,000 earthquakes and explosions and measure relative arrival times to ~0.01 seconds, enabling lateral location precision of about 100-300 meters. This is important for studies of seismic hazard, understanding earthquake physics, and nuclear test ban verification. Recognition and measurement of repeating signals in archived data and the resulting improved locations quantifies the inaccuracy of current procedures for picking onset times and locating events.

A pair of similar events in China filtered from 0.5 to 5 Hz. X-axes are travel time in seconds. Y-axes are normalized to unit amplitude. Lower subpanels are enlargements of the white and gray segments. The predicted P wave arrives at 143 s, the S wave arrives at 256 s, and the Lg wave arrives at 315 s.

1301 events (9% of the Annual Bulletin of Chinese Earthquakes – ABCE), 950 doublets satisfying the criteria of cross-correlation coefficients greater than or equal to 0.8 for long windows from 5 seconds before the P wave to 40 sec after the Lg wave on waveforms that are filtered from 0.5 to 5 Hz. Recording stations archived at IRIS are denoted with filled triangles. Events are plotted at their ABCE absolute locations.