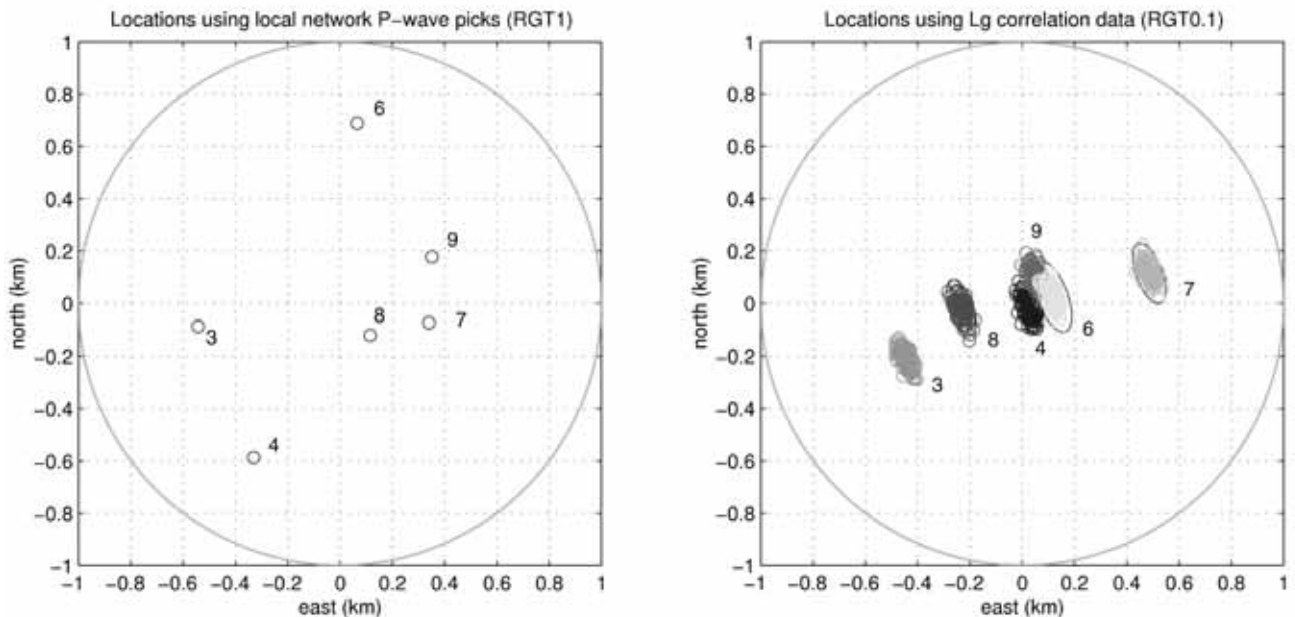


Lg-Wave Cross Correlation and Double-Difference Location

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A surprising discovery has been made that in some cases the complex, highly-scattered Lg wave is found to be similar for clusters of events. We analyze in detail a subset of 28 events out of 90 from the 1999 Xiuyan sequence. Cross correlations provide highly accurate differential travel-time measurements. The error estimated from the internal consistency is about 7 ms. These travel time differences are then inverted by the double-difference technique to obtain epicenter estimates that have location precision on the order of 150 meters. The locations are computed with data observed by four to five regional stations 500 to 1000 km away. The epicenter estimates are not substantially affected by the sparseness of stations or large azimuthal gaps. Comparison with a surface trace a few km away and location estimates based on much more dense networks lead us to conclude that the absolute positions are accurate to the 5 km level. Regional event locations must often be based on a small number of phases and stations due to weak signal-to-noise ratios and sparse station coverage. This is especially true for monitoring work that seeks to locate smaller magnitude seismic events with a handful of regional stations. Two primary advantages of using Lg for detection and location are that it is commonly the largest amplitude regional wave (enabling detection of smaller events) and it propagates more slowly than P or Sn (resulting in smaller uncertainty in distance for a given uncertainty in travel time).



Comparison of double-difference relative locations for a subset of events in the sequence for a local/regional network (left) using only P-wave phase picks recorded at several hundred stations and for a sparse regional network (archived at IRIS) using Lg cross-correlation measurements (right). The rms travel time residuals are about 1 sec for the P waves and 0.02 sec for Lg. 95% confidence formal error ellipses and bootstrap errors (shaded small circles) are in good agreement (right). Origin in each case is taken as the centroid of the cluster.

Schaff, D.P., and P.G. Richards, Lg-wave cross correlation and double-difference location: application to the 1999 Xiuyan, China, sequence, *Bull. Seismol. Soc. Am.*, 94, 867-879, 2004.