The M 7.7 September 24, 2013 Pakistan earthquake: comparison of back-projection images and field data

WANG, Dun[1]* ; MORI, James[2] ; KAWAKATSU, Hitoshi[1]

[1]Earthquake Research Institute, The University of Tokyo, [2]Disaster Prevention Research Institute, Kyoto University

We analyzed the 24 September 2013 Pakistan earthquake (Mw 7.7) by back-projecting seismograms recorded by several large regional arrays in Japan, China, and Europe. The results show that the rupture propagated towards the southwest, and released most of the high frequency energy at 90-130 km southwest of the epicenter around 20-40 s after the initiation. This rupture pattern is significantly different from the northward propagation which would have been expected from the aftershock distribution.

High frequency images suggest that the average rupture speed is 4.0 to 5.0 km/s. The rupture speed seems relatively slow (1.0 to 2.0 km/s) for the first 10-15s, and then increased to fast, possibly supershear (4.0 to 6.0 km/s). Relatively lower frequency images show a lower rupture speed of 3.0 to 3.5 km/s (Figure 1).

A comparison of rupture traces determined by the back-projection and a geodetic study provides a good test for resolution of the back-projection method. Given a correct epicenter location, results derived from seismograms recorded in Hi-net, show a very accurate location of the surface trace with an uncertainty of 10-20 km.

Figure caption
Figure 1 Timings and amplitudes for the stack with the maximum correlation at each time step (1 s) showing in the map (top) and as a function of time derived from data recorded in Europe, China, and Japan (from left to right) filtered in several high frequency bands (bottom). Here the distance is measured in a straight line from the relocated epicenter.

Keywords: source process, back-projection, slip model, rupture speed